

TT 1539

HOME MECHANIC'S WORKSHOP COMPANION



TELLS HOW TO DO MANY USEFUL
ELECTRICAL AND MECHANICAL THINGS
INCLUDING NUMEROUS SHOP KINKS

By
ANDREW JACKSON JR.

①

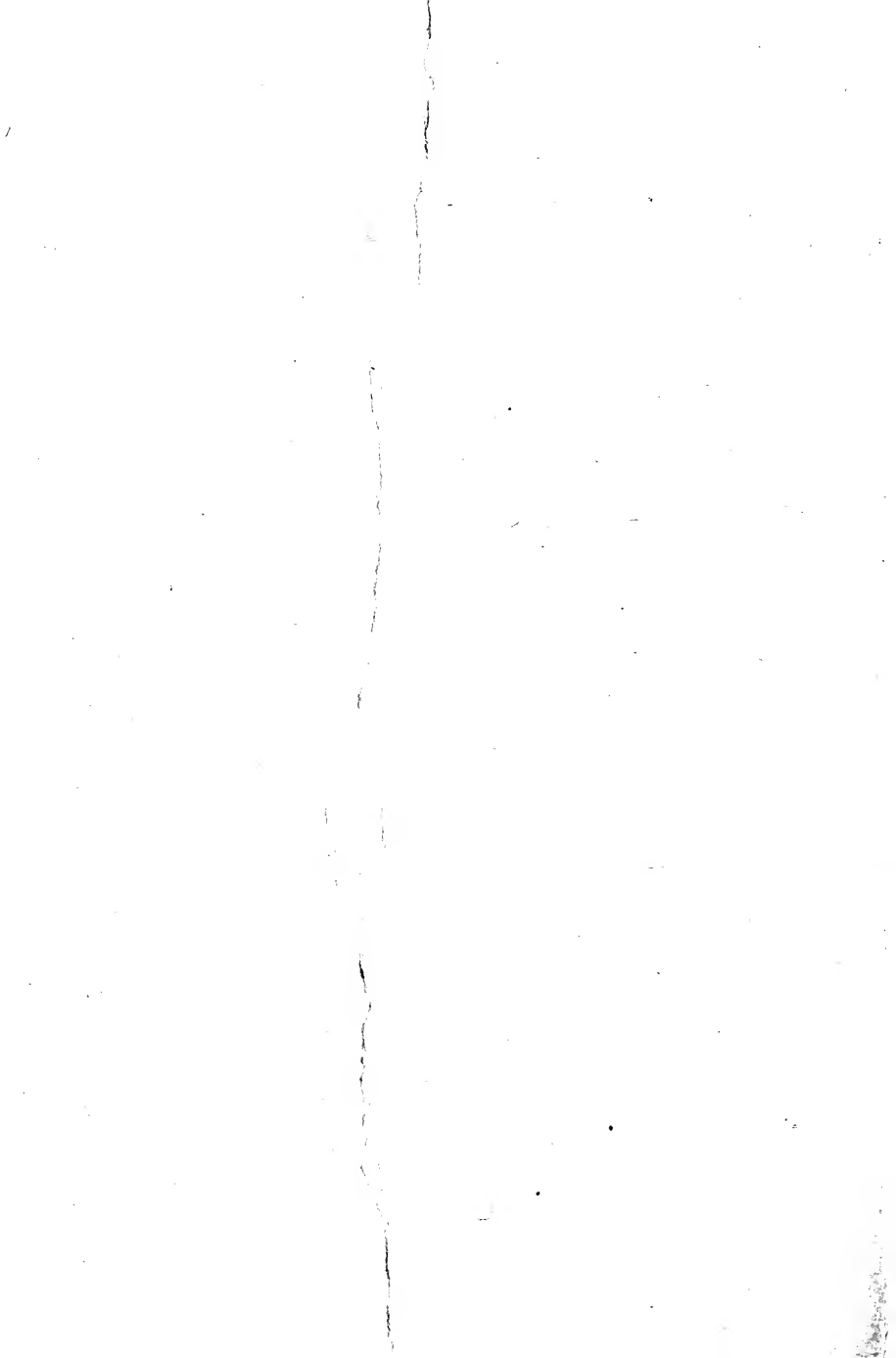
EVERYDAY ENGINEERING SERIES
NORMAN W. HENLEY PUBLISHING CO.
2 WEST 45 TH. STREET, NEW YORK

LIBRARY OF CONGRESS

1920



0 013 826 521 3



HOME MECHANIC'S WORK SHOP COMPANION

A complete manual for all who are interested in the equipment and use of the home workshop outlining wood and metal working tools needed, workbench construction, bench furniture and supplies, special tools and shop expedients, construction of useful home appliances, how to do things electrical and helpful recipes and formulae

BY

ANDREW JACKSON, JR.

SPECIAL CONTRIBUTOR "EVERYDAY ENGINEERING MAGAZINE"



A BOOK FOR THE EVERYDAY MAN WHO LIKES
TO WORK WITH TOOLS

Contains many useful shop kinks and is thoroughly illustrated with hundreds of "thumb-nail" sketches made by the author and complete working drawings for making useful shop furniture

NEW YORK
THE NORMAN W. HENLEY PUBLISHING CO.
2 WEST 45TH STREET
1920

TT 153
.524

COPYRIGHTED, 1920
BY
THE NORMAN W. HENLEY PUBLISHING CO.

PRINTED IN U. S. A.

APR 21 1920

©CL A565628

Composition, Electrotyping and Press Work
By Publishers Printing Company New York

INTRODUCTION

For a number of years past, the author has derived considerable pleasure and has spent a portion of his spare time profitably in a small workshop located in his home. He has been very much interested in trying out many hints and kinks that have appeared in the current issues of the mechanical periodicals, and has kept a note book and made sketches of the many devices constructed that have proven useful about the home and shop.

The most practical and useful of the numerous suggestions tried have been grouped under chapter headings to make for logical presentation and easy reference, and the many devices illustrated and described cannot fail to be helpful and suggestive to men of mechanical bent.

The construction of a shop bench and the items of tools and supplies that will be found useful in making light repairs to the home and its furnishings are considered because it is believed that many men who are about to establish or amplify small workshops can obtain suggestions that may help them from the experience of the author, who is not a mechanic by trade, but just a self-trained handy man who likes to use good tools in "puttering" around the house. Many light repairs have been made at a material saving that would otherwise have called for more expert, and needless to say, more highly paid mechanics than the writer. Any man or boy will find that a knowledge

of the use of ordinary tools for working wood and metal will come in handy in many ways, and provide entertaining and profitable employment for time that is ordinarily wasted.

ANDREW JACKSON, Jr.,
New York City.

TABLE OF CONTENTS

CHAPTER I

THE HOME WORKSHOP AND ITS EQUIPMENT

Selection of Shop Space—Construction of Workbench—Simple Bench Furniture—Keeping Tools in Their Places—Tools and Equipment—Lighting the Workbench—Combined Sawhorse and Tool Carrier—Wood-working Tools—Metal-working Tools—Supplies for Home Workshop9 to 43

CHAPTER II

SPECIAL TOOLS AND SHOP EXPEDIENTS

Two-foot Rule for Laying Out Angles—Lamps for Fine Soldering—Soldering—Iron Heater—Non-Spilling Acid Cup—Home-Made Blow Torch—Improvised Tools—Wooden Hacksaw Frame—Cabinet Scraper Handle—Inexpensive Marking Gauge—Stunts With Hammers—Soft Faced Hammer—Wedging Hammer Handles Securely—Stowing Away the Nail Set—Repairing Cracked Hammer Handle—Emergency Wrench for Turning Pipe—Kink for Sharpening Skates—Small Jaws for Holding Screws—Home-Made Expanding Bolt—Insulating Plier Handles—Use of Drill Gauge—Removing Stud Bolts—Simple Saw Clamp—Extemporized Sawing Gauge—Repairing Wood Boring Bits—Screw Inserting Tool—Soldering Iron Kinks—Simple Pipe Wrench—Using Wrench for Pipe Cutting—Suggestions for the Home Painter—Simple Paint Brush Wiper—Keeping Brush Handle Clean—Handle Hook—Extension Handle for Brush.....44 to 64

CHAPTER III

USEFUL HOME APPLIANCES

Keeping Ladder from Slipping—Practical Ladder Extension—Easy Rest for Feet—Metal Scaffold Bracket—An Intermediate Ladder Step—Using One Lock for Three Drawers—Double Bolt for Door—Secure Locking Means—Furnace Door Opener—Furnace Door Stop—Automatic Draft Opening Means—Broom Hanger—Skirt or Pants Hanger—Easily Made Door Spring—An Economical Door Stop—Useful Kitchen Appliances—Easily Made Pan Cover—Holder for Milk Bottles—Drinking Glass Holders—Keeping Spoon Out of Kettle—Home Water Works—Garden Hose Repair—Keeping Hose Packing Washers in Place—Repairing Leaky Faucet—Home-Made Hose Reel—Useful Hand Trucks—Package Carrier for Bicycles—Picture Frame Hanging Made Easy—Metal Corners From Tubing—How to Fasten Floor Boards—Making Wood Screws Tight—Raising a Sagging Door—Efficient Cord Cutter—Locating Drain Pan—Preventing Splash of Waste Water—Cleaning Dirt Out of Corners—Combined Broom and Ice Pick—Sleeve Pressing Board—Ironing Board Support—Shoe Polishing Stand—Indoor Clothes Hanger—Improving Linen Closets—Storing Kettles and Pans—Trousers Hanger for Closet—Installing Curtain Pole—Using Electric Flat Iron for Stove—Range Boiler Repairs—Cheap Candle Lamp—Keeping Soot in Stove Pipe—Clipping Trees Without a Ladder—Doubling Capacity of Spring Balance—Simple Magazine Rack—Cabinet for Wood-working tools65 to 111

CHAPTER IV

HOW TO DO THINGS ELECTRICAL

Electric Bell and Annunciator Wiring—Push Button Construction—Electric Wires and Wiring—Simple Batteries—Dry Cells—Wiring Dry Cells—Electric Bell Construction—Simple Bell Circuits—Conventional Domestic Installation—Joining Wires—Overflow Alarm—Simple Annunciator—Electric Alarm Clock—Simple Fire Alarms—Simple Terminals—Magnetizing Shears—Using Partly Worn Zincs—Cost of

Operating Electric Cooking and Heating Devices—Electrically Operated Door Locks—Replacing Defective Fuses—Simple Attachment Plugs—Controlling One Lamp From Two Points—Home-Made Night Light—Drop Light Adjusters.

112 to 141

CHAPTER V

HELPFUL RECIPES AND FORMULÆ

Cleaning Waste Pipes—A Superior Whitewash—Silvering Metals—Writing on Steel—Black Lacquer for Metal or Wood—A Good Polish for Brass—Filling for Cracked Ceilings—Filling Cracks in Floors—Fastening an Umbrella Handle—To Frost Glass—To Brighten Silver Plated Articles—To Remove Rust From Steel—Cleaning Marble—Cleaning Paint—Removing Hard Wax and Candle Grease From Cloth—To Remove Soft Grease Spots From Fabrics—Preparation for Cleaning Gloves—Eradicating Ink Stains—Miscellaneous Cements and Adhesives—Marine Glue—Glue to Resist Damp—Rubber Cement—Cement to Mend Crockery—Cements for Pipe Joints—Cement for Iron—Paste for Sticking Paper Labels to Glass, Wood or Metals—Adhesive Material—Alum and Plaster-of Paris Cement—Indestructible Writing Ink—Removing Ink Stains From Wood—Preserving Leather—Oiled Dust Cloth—Detection of Gas Leaks—How to Read a Gas Meter—Cleaning Stove Pipes—Varnish for Stove Pipes—French Polish Revivers—Paints for Boiler Fronts. 142 to 154

INDEX 155 to 159

Home Mechanic's Workshop Companion

CHAPTER I

THE HOME WORKSHOP AND ITS EQUIPMENT

Selection of Shop Space—Construction of Workbench—Simple Bench Furniture—Keeping Tools in Their Places—Tools and Equipment—Lighting the Workbench—Combined Sawhorse and Tool Carrier—Wood-working Tools—Metal-working Tools—Supplies for Home Workshop.

The man who likes to work with tools is found in many different walks of life; some have mechanical trades and some are business and professional men. The workshop equipment naturally varies with the mechanical skill of the owner and the character of work he wishes to do. Some home mechanics, interested in model making and experimental science, have very complete shops, with a lathe and other mechanical equipment. This treatise is not intended for a mechanical expert or a man carrying on experiments of an electrical and scientific nature. It is intended as a handy manual for the average man who desires to rig up a small shop where he can do odd jobs in constructing household appliances, making needed light repairs to the home and its furnishings and spend

long evenings to advantage in building simple pieces of cabinet work.

Selection of Shop Space.—The important requirement in the location of the shop is that it be situated in a clean, light, warm and well ventilated place. If a suitable small building is available, such as a section of an automobile garage, as many handy men are also car owners, the problem is easily solved. If only light work is to be done, an attic room may be converted for shop purposes, but if heavier work is to be attempted, such as building substantial furniture or perhaps a small boat, then the shop should be located in a more accessible place. The basement of the modern home is usually well suited for shop purposes, as it is dry and warm in the winter because of the furnace location. The problem of lighting is easily met by the almost universal use of electricity in present day homes and there is always some corner convenient to an areaway where sufficient daylight is available. Large objects are more easily brought into or carried out of the cellar than the attic.

The point to be impressed on the average home mechanic is that much time is saved and work is more easily done when working conditions are good. The shop should have a good workbench, cabinets or chests for tools and supplies and an adequate amount of such small hardware as is necessary to take care of the ordinary odd jobs. Tools should be of good quality, because such tools last a lifetime if given ordinary care, while cheaply made tools are never satisfactory, and should not be purchased, because any money expended for them is practically wasted. One can do accurate work only with good tools. A dull saw or chisel that will not hold its edge—is an abomination, and many men who really have mechanical ability are discouraged in their attempts to do work by the

handicap of improper tools. While a large variety of tools for both wood and metal-working purposes are to be described, the selection naturally rests on the individual, who should purchase those that are needed and best adapted for the work in hand. The list of supplies is given only in a suggestive sense, as many of the materials mentioned can be purchased as required. More tools will be needed if one intends to

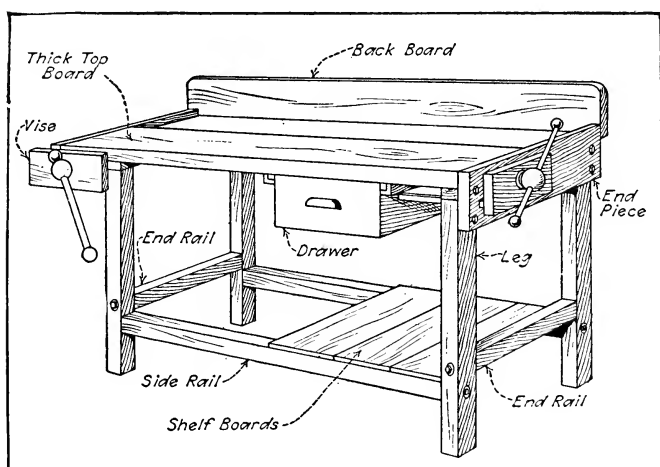


Fig. 1.—Simple and Substantial Workbench for Home Workshop Use.

work both wood and metal than if wood alone is to be the medium for expressing one's mechanical ability.

The storage of tools is important. They should be kept clean and dry so they will not rust and be stored away in such a way that cutting edges will not be damaged or the tools distorted. Saws should be hung in cabinets, planes kept in boxes or laid on their side in a special place where other tools will not

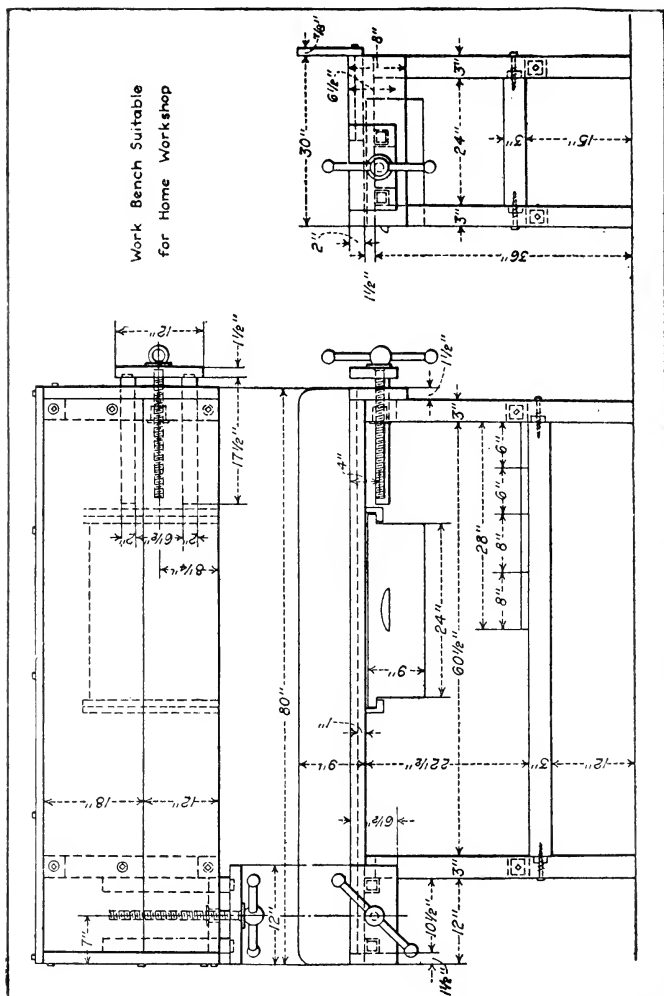


Fig. 2.—Working Drawings Giving Construction Dimensions of Home Workshop Bench.

come in contact with them. Drills and bits should be kept in drilled wood or metal blocks. Files should never be thrown in promiscuously with other tools. Chisels ought to be kept as sets in racks or boxes and their cutting edges protected. The main thing is to have a place for everything and to keep everything in its place.

Construction of Workbench.—The most important item of workshop equipment and the real basis of the shop is the workbench. These vary in construction from roughly boarded packing boxes and old tables to very complete and elaborate factory made benches almost as complex as a kitchen cabinet. The bench shown at Fig. 1 is a substantial yet simple workbench that can be made by any handy man with tools at much less cost than the expense of purchasing one of as good quality ready-made. It is a handy size that has been used by the writer in his own small shop with excellent results. The drawer provides ample accommodation for small tools and supplies, the shelf beneath can be used for keeping more bulky objects off the floor. While two vises are shown the one at the end of the bench for handling short work can be replaced with a metal machinist's vise and then the bench becomes suitable for both wood and metal working.

The working drawings at Fig. 2 give all the important dimensions and details at Figs. 3 and 4 will further clarify the explanation. The over-all dimensions are 6' 6" long, 3' 3½" high and 30" wide. Either birch or maple may be employed as both of these woods make a very good bench. Oak or ash legs and rails and ash planking will also be a very satisfactory combination. The necessary stock may be purchased from any lumber mill ready planed and cut to length, in which case considerable labor will be saved.

The following is a bill of material if dressed lumber is purchased:

<i>Name of Part</i>	<i>Number Required</i>	<i>Size</i>
Bench Legs	4	3" x 3" x 36"
End Rails	2	3" x 3" x 24"
Side Rails	2	3" x 3" x 62½"
Back Board	1	⅞" x 9" x 80"
Top Board (Front)	1	2" x 12" x 77"
Top Board (Center)	1	⅞" x 6" x 77"
Top Board (Back)	1	⅞" x 12" x 77"
Crosspieces	2	1½" x 3" x 30"
Clamps for Vise	2	1½" x 6½" x 12"
Vise Clamp Guides	4	2" x 2" x 18"
Screw Blocks	2	3" x 3" x 6"
End Piece	2	1½" x 8" x 30"
Shelf Boards	2	⅞" x 8" x 30"
Shelf Boards	2	⅞" x 6" x 30"
Drawer Front	1	⅞" x 9" x 24"
Drawer Back	1	⅞" x 9" x 24"
Drawer Sides	2	⅞" x 8" x 22"
Drawer Bottom	2	⅞" x 6" x 24"
Drawer Bottom	2	⅞" x 5" x 24"
Cleats for Drawer Side	2	1" x 1" x 22"
Slides for Drawer	2	⅞" x 2¼" x 24"
Slides for Drawer	2	1" x 1" x 24"

Besides the wood pieces enumerated above, various items of hardware will be needed. These include one drawer handle, two dozen ⅜" x 5" lag screws, 2 doz. ⅜" iron washers, 3 doz. wood screws about 1½" long, 1 pint linseed oil and 2 malleable iron vise screws complete with handle, collar bearing and nut as shown at Fig. 5, this screw being about 1" or 1¼" in diameter and 24" long. Wooden vise screws can be obtained, but these are not as satisfactory as the iron ones and not much cheaper. If the worker desires he can obtain a very satisfactory carpenter's bench vise as shown at Fig. 5, this being purchased complete and ready for installation to the bench side or end.

Of the lumber specified, the material for the center and back top boards, the back board, the shelves and for making the drawer need not be anything more than pine as no great wear comes upon these parts. The bench top front board should be of maple or birch, also the vise clamp and bench end pieces. The legs may be of maple, birch, oak or ash, the end rails and side rails of any of these woods. The wood should be clear grained, free from knots or checks or surface blemishes.

The first step is the construction of the lower frame. As the rails are held into the posts by mortise and tenon joints, reinforced by an iron lag screw as shown at Fig. 4, the first step is to cut the tenons on the ends of each rail, side or end, and the corresponding mortises in the bench legs. The tenons are 2" square by 1" deep, so the mortised-out places on the legs must be of corresponding size. The mortises for the side rails are cut 12½" from the end that is to rest on the floor, those for the end rails are cut 15½" from the end. When the mortise and tenon joints are made, the rails are assembled to the legs. A ⅜"-hole is drilled through each leg into the center of the mortise and a ¼" hole into the tenon at each end of the rail about an inch in depth. The legs and rails are then fastened securely together by the 5" x ⅜" lag screws, the threads of the screw being covered liberally with yellow soap to insure its screwing into the rail end easily. An iron washer is placed under each lag screw head to prevent its sinking into the wood. The crosspieces are fastened to the top of the legs by lag screws, the heads being countersunk or wood screws may be used of about ¼" shank and 4" long. An alternative to counter-sinking the screw heads if lagscrews are used is to drill holes in the bottom of the top boards to fit over them. The front

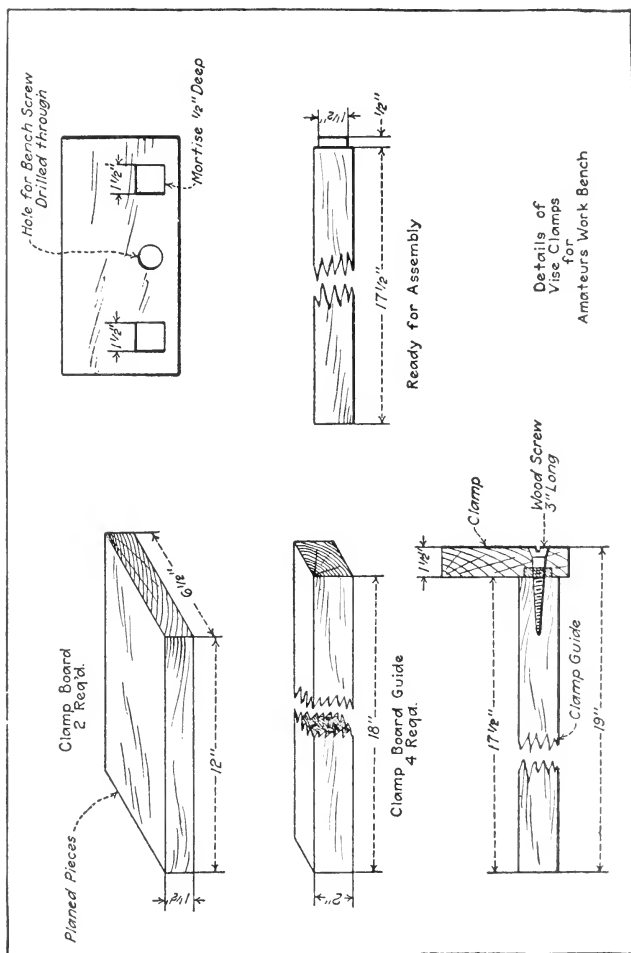


Fig. 3.—Details of Vise Clamp Design for Home Workshop Bench.

top board is then fastened to the crosspieces by substantial screws, such as short lags, put in from the bottom and the screw should not be over $2\frac{1}{2}$ " long. The center and back top board may be put in and held with screws from the top.

The next step is to cut the mortise and tenon joints in the clamp board and clamp guide pieces and assemble as shown at Fig. 3. A hole is bored through for the bench screw as indicated. The tenons are set in glue and held securely by a countersunk head wood screw about 3" long. The vise or bench screw block pieces are fastened to the bottom of the bench and a hole bored through, using that in the clamp board as a guide for the nut of the vise screw. The end board is provided with square holes to take the clamp guides or slides and a round one providing clearance for the vise screw. It is then fastened to the legs by substantial countersunk head wood screws.

The back board is then fastened in place with wood screws. The installation of the shelf boards is a very simple matter, these being placed on top of the side rails and secured thereto with wood screws. The pieces comprising the drawer are assembled with nails or screws, the latter being preferred. The back and front pieces are fastened to the sides, all four pieces lining up at the top. This will leave the front and back of the drawer projecting down 1" from the sides. When the drawer bottom boards are nailed on across the sides, this space is taken up, and the drawer becomes a box 24" square by 9" deep outside and 8" deep inside. The 1" square cleats are fastened along the top of the drawer sides with screws and the drawer slides are attached to the bench top under side as shown at Fig. 4.

An alternative method of drawer support is shown at Fig. 4, B. In this, the 1" angle iron slides are bolted

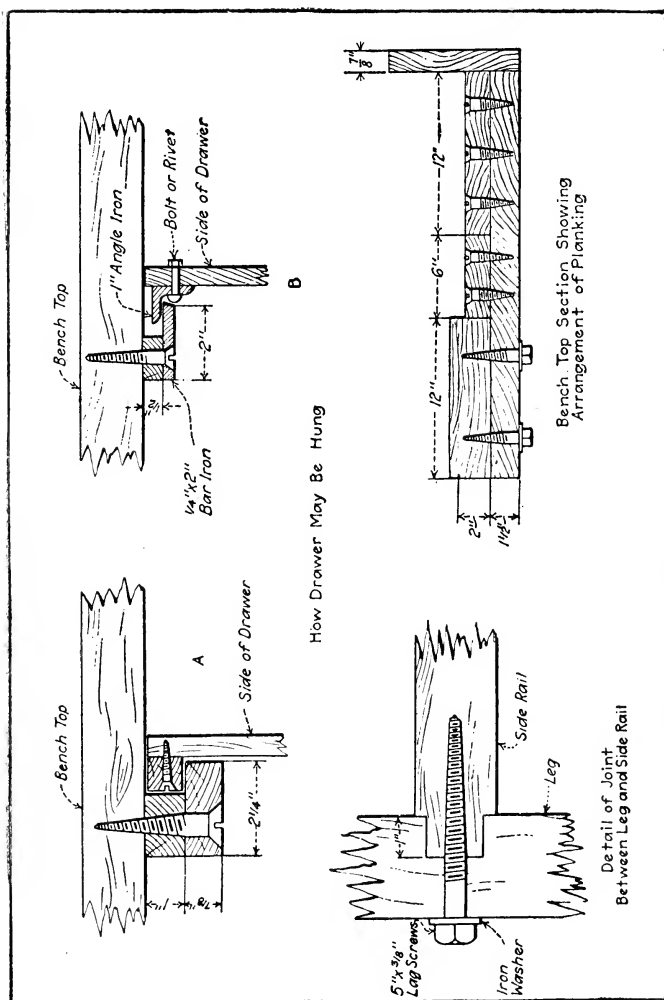


Fig. 4.—How Drawer May Be Hung and Other Details of Workbench Construction.

or riveted to the drawer side and these work on metal guides composed of $\frac{1}{4}$ " x 2" iron bars of rectangular section screwed through wood spacer cleats $\frac{1}{2}$ " x 1" to the bench. After the bench is assembled, all the lag screws in the frame are tightened up. Then the bench is gone over with sandpaper and smoothed, after which the smooth surfaces are given a couple of coats

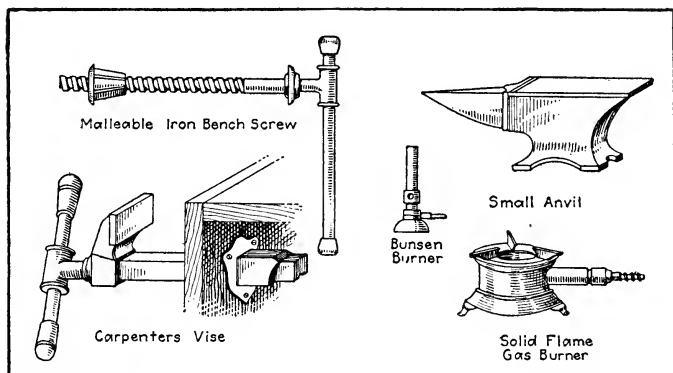


Fig. 5.—Useful Items of Bench Equipment Showing Malleable Iron Bench Screw and Carpenter's Metal Vise.

of linseed oil which not only preserves the wood but also gives it a good finish.

Simple Bench Furniture.—There is a certain amount of bench equipment, such as stops, etc., that can be purchased very cheaply. A simple stop that can be placed at the end of a bench to hold the end of a board in place when planing it on the flat side is shown at Fig. 6, A. This is easily made of two pieces of hard wood, two iron washers and two lag screws. The vertical piece may be adjusted up and down to compensate for the thickness of the piece, the horizontal piece serves as a clamping member. In moving the vertical piece, it is necessary to slack the lag screws

out slightly to release the clamping pressure. This can also be used as a vise for holding small work.

The clamp or vise shown at B, Fig. 6, is easily made by any blacksmith and it may be used either vertically by passing it through a hole in the bench top or as a vise for holding work at the bench end by providing a suitable hole for the screw rod to pass through. The construction is so clearly shown that further description is unnecessary.

The simple fixture shown at Fig. 6, C, is of value when light wood pieces such as molding is to be sawed, and by cutting saw slots at various angles in the stop board at the end as a guide, it serves as a simple and effective miter box. It is also handy in holding short pieces of wood, such as blocks, when these are to be planed. It is made of a piece of $\frac{7}{8}$ " board about 8" wide x 14" long, and two pieces as stops, one $\frac{7}{8}$ " x 2" x 8", the other the same width and length but only $\frac{1}{2}$ " thick. To use this fixture, it is merely placed on the bench and pushed against one of the stops, the work being rested against the other as shown. The object of having one stop shorter than the other is so that wood less than $\frac{7}{8}$ " thick can be planed by placing it against the thin stop piece instead of the thick one. The end pieces may be held by brads or screws.

A wood jaw vise can be converted to one that will hold metal pieces by a simple expedient as outlined at Fig. 6, D. Two old files are needed, either 12" or 14" long, of flat, rectangular section. The files are heated to a red heat and allowed to cool slowly in ashes or in the air. Holes are drilled as indicated and counter-sunk in pieces cut from the files of sufficient length to fit the vise jaws. The vise jaws are cut back about half the thickness of the file, thus providing a ledge for the piece of file to rest against. The pieces are

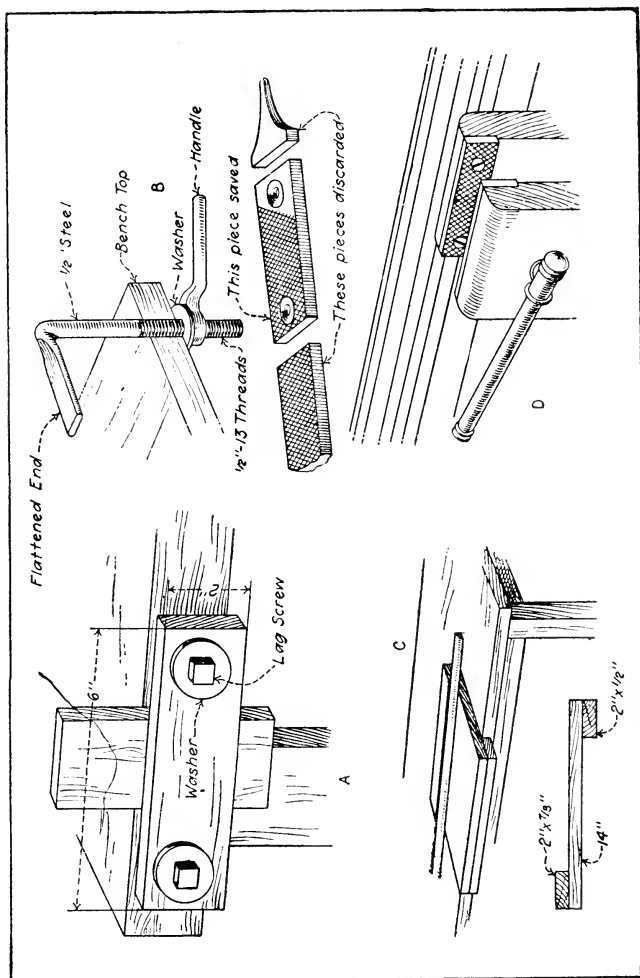


Fig. 6.—Easily Made Appliances for Use With Home Workshop Bench.

then fastened to the jaws with countersunk head screws. The file teeth provide a good grip on metal pieces held in the vise, and, as they are soft, they are not as brittle as they are in their hardened condition and they are not apt to crumble away.

Keeping Tools in Their Places.—A very satisfactory method of keeping tools out of the way when not in use and yet have them accessible when needed is shown at Fig. 7, A. This is a rotating tool rack that may be easily constructed by the home mechanic and installed without trouble. While it is shown attached to the bench at the bottom in sketch, it may be supported by wall brackets at both ends and kept clear of the bench if desired. Round wooden or sheet steel discs are provided with a series of holes to receive various small tools. The rod may be of wood, such as an old broom handle, of iron bar or pipe; a good way is to use pieces of pipe as spacers between the discs, assembling the pipes and discs around a central steel rod member which has nuts top and bottom to hold pieces together.

The common methods of making tool racks are shown at Fig. 7, B. In this the wall or backboard of the bench is utilized as a support for wooden blocks used as spacers, while a lath serves as a closure member for the spaces left between the blocks to hold the tools. The method of using a leather belt or strap for the same purpose is also clearly outlined. Loops of various sizes are made by the irregular spacing of the retention screws.

Spring holders as outlined at C may be made by the handy man, these being held to the wall by a wood screw. In addition to the main clamping spring jaws which will hold any ordinary handle, the small loops will hold various small tools without trouble, such as gimlets, brad-awls, scissors, etc. A spring holder of

this form is very useful for holding brooms, mops, rakes, and other long-handled household or garden tools if made heavier than would be required for less weighty tools.

A more pretentious rack for holding tools and small pieces in process is shown at Fig. 7, D, and this may be

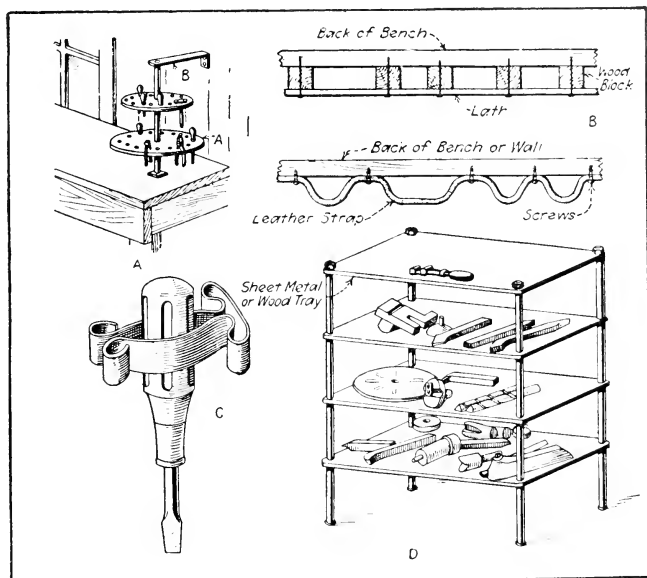


Fig. 7.—Suggestions for Having Tools Accessible Yet Keeping Them Out of the Way on Workbench.

made of any desired size so it can be placed on the bench, or in the larger sizes, on the floor. The shelves are made of steel plates and are supported by four bolts passing through them and having pipe spacers between them. A small rack suited for the bench can be assembled of plates or boards about 12" x 24", using $\frac{1}{4}$ " rods as bolts and $\frac{3}{8}$ " pipe spacers. A larger size for floor use could be made of $\frac{1}{2}$ " rods, $\frac{3}{4}$ " pipe

spacers and steel plates 24" x 30" or built-up wood shelves of any desired size.

The small racks shown at Fig. 8 is made of muffin pans or cup cake tins in combination with a roasting pan, using bolts and pipe spacers to hold the assembly together. The depressions in the pans make ideal depositories for nails, tacks, small screws, nuts, and make it possible to keep the various sizes separated and easily accessible. The pans are spaced 4" or 5" apart, nuts at the top and bottom of the rods serving

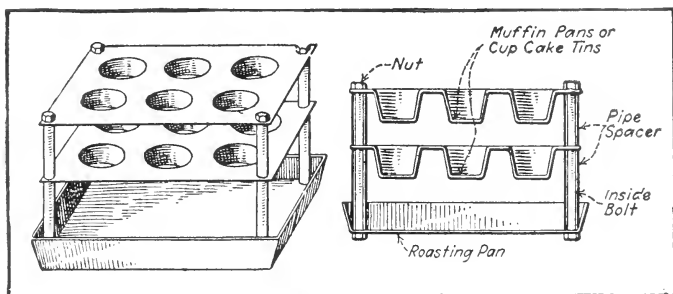


Fig. 8.—How Ordinary Tinware May Be Used as Containers for Screws, Nails and Other Materials.

to clamp the entire assembly together. The rods need not be more than $\frac{3}{16}$ " cold rolled; the pipe spacers are the so called $\frac{1}{8}$ " gas pipe size, which have a bore of about $\frac{3}{16}$ ". The materials to construct such a rack need not cost more than 30 or 40 cents.

A very simple revolving rack is shown at Fig. 9, this also being composed of muffin tins of the round form that have six or seven cups. The method of assembling this is clearly outlined and it is a very useful receptacle for small supplies. The single bolt or bearing is about a $\frac{3}{8}$ " rod, the pipe spacers need not be a tight fit. In fact, wood tubes could be used. The use of pipe makes it possible to use a floor or

wall plate as a convenient base. The materials for a rack of this kind is also very inexpensive. The advantage of the rectangular rack shown at Fig. 8 is that it can be moved about on the bench. That at Fig. 9 can be placed at any point where it will be out of the way. Its lack of mobility is made up by the security ob-

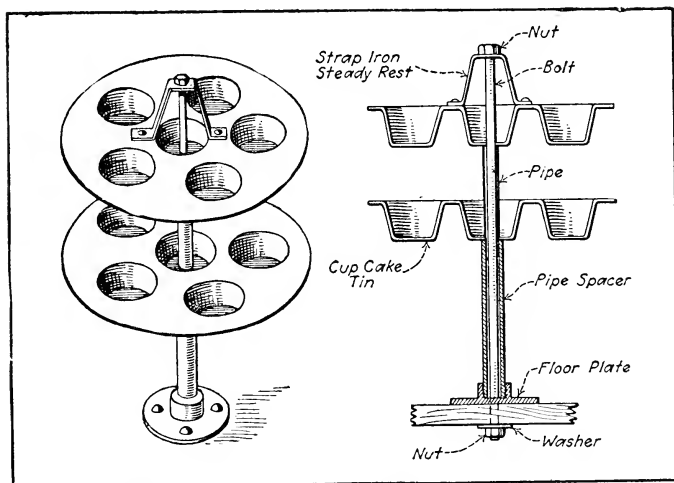


Fig. 9.—Revolving Racks for Small Hardware May Be Made Easily of Muffin Tins.

tained by not being able to tip it over and spill out the numerous and widely diversified contents.

Tools and Equipment.—In considering the various items of tools and equipment that can be purchased, the list is made more complete than the average home mechanic would be apt to need, yet it will not be sufficiently large for the hobbyist and mechanical experimenter. If much metal work is to be done, a small anvil as shown at Fig. 5 will be a useful adjunct to the bench equipment. The solid flame gas burner is very useful for heating the glue pot, soldering iron and

other work of that nature. The Bunsen burner is also useful where an intensely hot but concentrated flame is desired.

A group of useful appliances for the wood-worker is given at Fig. 10. The wooden clamps are the form usually employed by carpenters and cabinetmakers for holding pieces in gluing, etc. The C clamps in forged steel are used in metal work while the malleable iron clamps may be used either for wood or metal. The

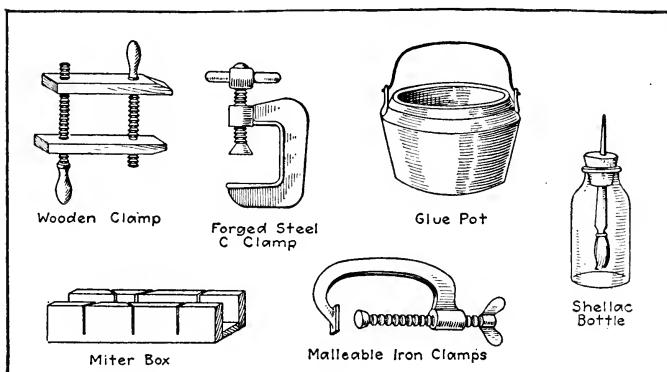


Fig. 10.—Useful Workbench Accessories That Can Be Used to Advantage by Home Mechanics.

water-jacketed glue pot is very good for the man who likes to mix his own glue, though the prepared glues that may be purchased in cans of various sizes usually answer the purpose of the amateur or home craftsman. The miter box may be made by the workman himself. It is really a saw guide and is used in cutting small wood pieces such as molding for picture frames, etc. The shellac bottle is nothing more than a pint or quart milk bottle, provided with a wooden stopper to which a chisel point brush is fastened to spread the shellac as shown.

Lighting the Workbench.—Where electricity is available the electric light is an ideal method of illuminating the workbench. The method of supporting the light, which is adequately shaded, shown at Fig. 11, is a very good one, as the lamp can be moved from one end to the other of the workbench and the lamp cord is kept clear of the bench. The cord is attached to wooden spools or small porcelain insulators with friction tape, these sliding freely on a piece of copper or steel wire stretched between two shelf brackets as indicated. These may be built up of wood pieces $1\frac{1}{2}$ " or 2" square, or may be purchased from any hardware store at small cost in either cast iron or pressed steel. They are used to support a shelf which is somewhat less in depth than that ordinarily used to allow the ends of the brackets to project about 2" from the shelf. The wire is stretched taut across the space between the brackets after the wire carrying insulators have been threaded on. There are two simple ways of anchoring one end of the wire so it can be kept tightly stretched. One of these is a screw eye and light turn buckle as shown at A; the other is an eyebolt which can be adjusted by the nut to tighten the wire as shown at B, Fig. 11.

Another expedient is the use of a series of screw-eyes on the front edge of the shelf, these being placed about a foot apart. The lamp may be provided with a hook made of spring brass as shown at C and this hook can be placed in any one of the screweyes on the shelf front, or supported at any desired point on the wire stretched between the shelf brackets, if that is used. A simple shade that may be made of tin plate, springy brass or other light, bright metal is shown at D, also the development or pattern so it can be cut from flat stock and afterward bent up. It is an excellent idea to protect any lamp used on the workbench

or in the shop with a wire cage guard to prevent lamp breakage in case it is dropped or hit with a piece of wood or tool. A shock-absorbing spring holds the

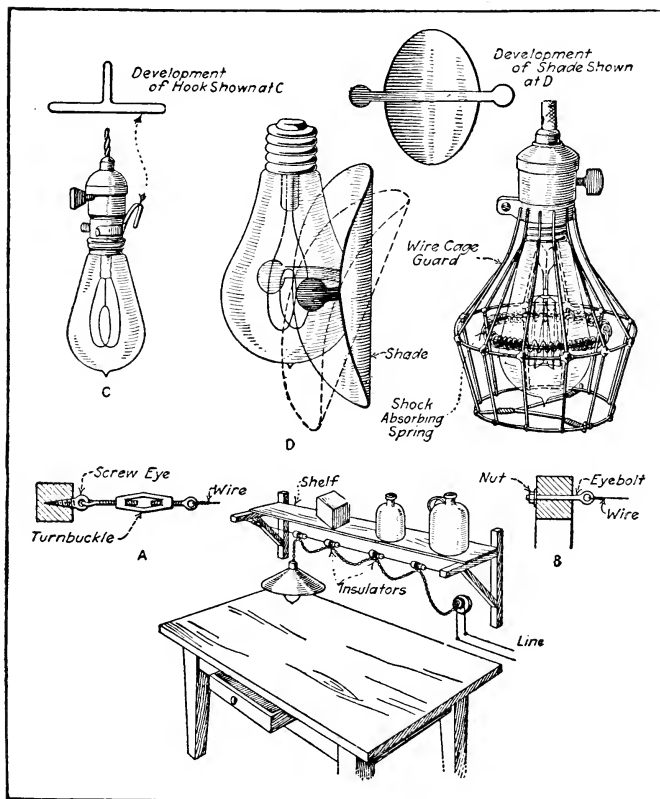


Fig. 11.—Suggestions for Lighting the Home Workbench if Electricity is Available.

screen away from the lamp bulb, which is a feature of some value if high efficiency lamps with fragile filaments are used. These guards may be purchased at

small cost and are made and installed as shown at Fig. 11, E.

Combined Sawhorse and Tool Carrier.—The handy man who makes repairs around the home cannot carry his tool outfit and workbench everywhere he goes and usually finds that the tool he needs most is not in the selection he brought from the shop. For any odd jobs of carpenter work, either indoors or out, the combined sawhorse and tool carrier shown at Fig. 12 will be found very useful. The box inside the frame serves

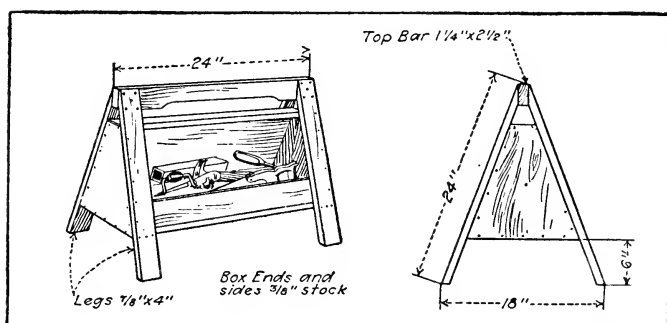


Fig. 12.—A Combined Tool Box and Small Horse is Valuable in Making Repairs Remote from the Shop.

a double purpose. It not only serves to strengthen the saw horse frame materially by its bracing effect but it acts as a container for a good assortment of tools. The trestle may be used for its normal use without trouble. It may be built by the home mechanic without any difficulty by paneling one side and the two ends the full height around a bottom shelf and putting on a front board to keep the tools from falling out. The dimensions given are merely for guidance, the important point to be observed is to make the trestle as light as possible so it can be carried around without too much trouble. Stock $\frac{3}{8}$ " thick will be

heavy enough for the box sides and ends and the legs can be made of $\frac{7}{8}$ " thick boards.

Wood-working Tools.—No workshop will be complete without a set of wood-working tools and very fortunately a very practical outfit can be purchased at comparatively small cost. Wood-working tools are

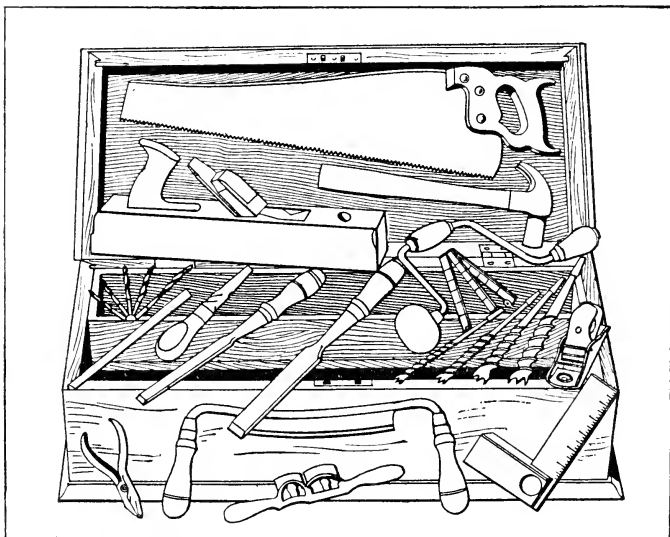


Fig. 13.—Tool Chest and Simple Equipment of Ordinary Tools Useful in the Home Workshop.

not only necessary in the home workshop but are of obvious utility in making repairs incidental to the up-keep of buildings, and the many odd jobs about the house. A very convenient outfit for use around the farm or shop is shown at Fig. 13 and can be purchased for \$15 to \$20. It consists of the following tools: One 22" hand saw, one 6" try square, one 2' rule, one pair 5½" combination pliers, one 10" bit brace, four auger bits, one each size $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ " and 1"; five

gimlet bits, one steel hammer, one 8" draw knife, one double cutter spoke shave, one 5" steel blade screw-driver, two socket chisels, one jack plane, one 5½" iron block plane and a carpenter's pencil. A plumb bob and chalk line, nail set, level and a large steel square can be purchased to complete this outfit at slight added expense, as well as other tools shown at Figs. 14 and 15.

The hardware necessary, such as nails, screws, staples, locks, hinges, etc., can be purchased as required, and soon enough of these supplies are left over when purchases are made from time to time so a very useful stock of miscellaneous small hardware accumulates without its cost being so apparent as would be the case if everything that was thought desirable was purchased outright.

As the skill of the workman increases, he may desire a more complete outfit than the simple and inexpensive tool chest at Fig. 13. For a variety of work, more tools are needed. The first saw to be purchased should be a "crosscut" or for cutting wood across the grain. For cutting wood with the grain, the crosscut saw will not be suitable and a "rip" saw will be needed as shown at Fig. 14. For cutting circles or arcs one will need a compass or keyhole saw. For use with either a patent adjustable metal or simple wooden miter box, a back saw will be needed as the others are too coarse for cutting light wood or fine moldings. The scroll or jig saw will be indispensable if pattern-making or model work is to be attempted.

The oilstone is needed for sharpening chisels, plane irons and other edge tools. A compass or dividers is needed for laying out arcs, circles or transferring measurements. The scratch gauge is for marking pieces that are to be rip sawed. A set of gauges, which are really chisels having a curved cutting edge

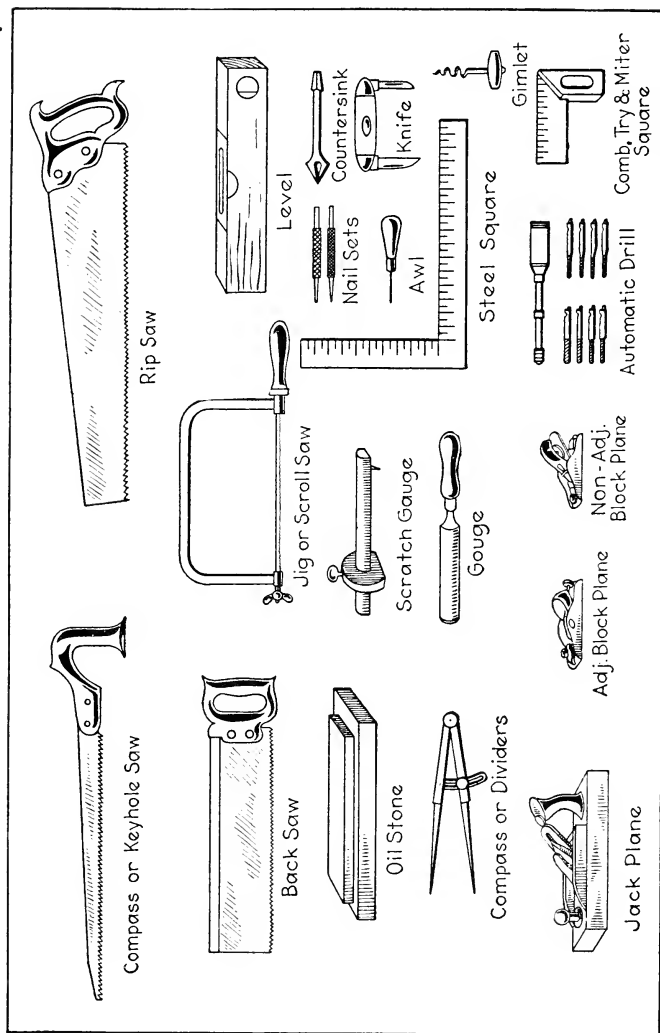


Fig. 14.—Tools That Can Be Used to Supplement Simple Outfit Shown in Fig. 13.

for working out round channels will be necessary if pattern work is to be attempted.

More useful tools are shown at Fig. 15. For general wood-work, especially on finished pieces, one should never use a claw hammer without interposing a block of wood to receive the force of the blow and to protect the surface. A wooden mallet is of value in fitting jointed pieces for hammering against chisel handles, and for all uses where the wood is not to be

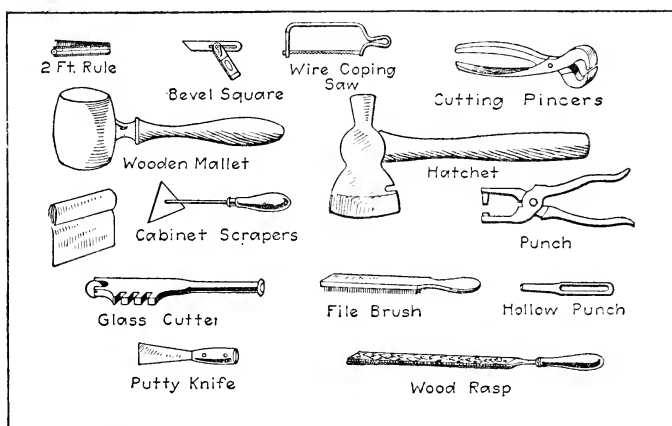


Fig. 15.—More Tools That Will Prove to Be Useful Additions to the Home Shop Outfit.

marred. Just as a metal hammer is not suitable for driving against wood, a wooden mallet should never be used against metal or for driving nails. The cutting pincers are handy in cutting off or drawing out small brads or nails that cannot be extracted with the claw hammer.

Cabinet scrapers are made in a variety of forms. The two illustrated are all the amateur needs. One having a broad, flat blade is used in scraping plane surfaces, the triangular blade form is used in small

spaces and for corners. A hatchet is very useful as it can be used for many rough jobs such as pointing and driving stakes, splitting short boards, hewing roughly to a line so planing can be done, opening boxes and crates and many other uses that will suggest themselves.

Punches are valuable for making holes in leather, cloth, rubber packings, etc. Two kinds are ordinarily used, hollow punches which are driven through the piece by hammer blows and belt punches which are

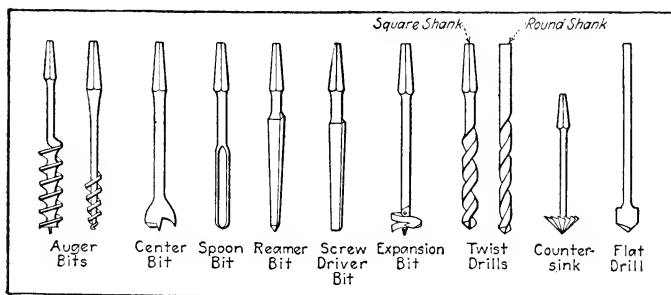


Fig. 16.—Wood Boring Tools Are Made in Many Forms and May Be Used in Bitstock or Hand Drill Press.

operated like plyers. The file card is very handy in cleaning wood or metal dust from the teeth of files or rasps. A wood rasp is handy for roughing and finishing edges of wood pieces instead of a plane. A glass cutter and putty knife will be needed if any glazing is to be done.

The various types of wood boring bits are shown at Fig. 16. The expansion bit is very useful as it permits boring a large number of sizes with the one tool, which has an adjustable cutting lip. The reamer bit is used in connection with the bit stock for enlarging holes in metal and is of tapering square or triangular section having sharp cutting edges. The screwdriver bit is

useful where a large number of screws are utilized to hold a piece.

Metal-working Tools.—Nearly all home craftsmen must work metal as well as wood, as that material enters largely into the construction of modern household appliances. As nearly everyone of a mechanical bent owns either a motorcycle or automobile or fusses around motorboats, it is necessary to have a certain equipment of metal-working tools as well as those used on the less resisting material, wood.

Groups of hand and bench tools to be employed in fabricating or repairing parts made of metal are shown at Figs. 17 and 18, these cuts showing only the most common tools, but they include all of the tools necessary to complete a very practical kit and it is not unusual for the handy man who is capable of overhauling his own car to possess even a larger assortment than indicated. The small bench vise provided is a useful auxiliary that can be clamped to the workbench and should have jaws at least three inches wide and capable of opening four or five inches. It is especially useful in that it will save wood-working bench vises, as it has adequate capacity to handle practically any of the small metal parts that need to be worked on when making home repairs.

A blow torch, tinner's snips and soldering copper are very useful in sheet metal work and in making any repairs requiring the use of solder. The torch can be used in any operation requiring a source of heat. The use of the wrenches, screwdrivers, and pliers shown are known to all and the variety outlined should be sufficient for all ordinary work of restoration. The wrench equipment is more than usually complete, including a spanner wrench, adjustable end wrenches, a thin monkey wrench of medium size, a bicycle wrench for handling small nuts and bolts, a Stillson wrench

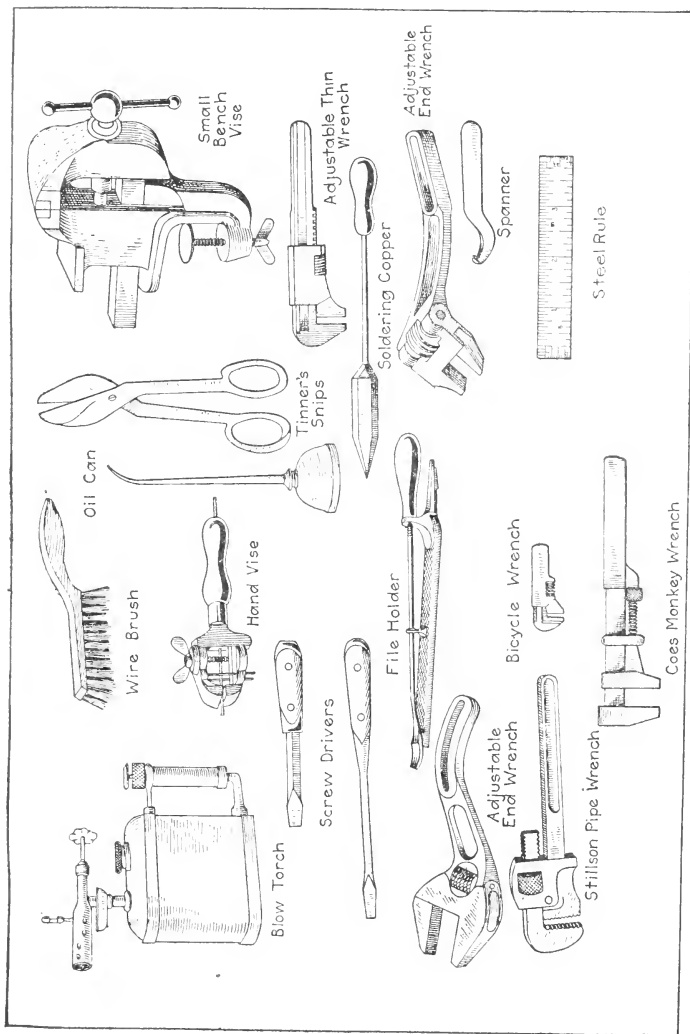


Fig. 17.—Group of Metal Working Tools That the Home Mechanic Will Find Indispensable.

for pipe and a large adjustable monkey wrench for all stubborn fastenings of large size.

Three different types of pliers are shown at Fig. 18, one being a parallel jaw type with size-cutting attachment, while the other illustrated near it is a combination parallel jaw type adapted for use on round work as well as in handling flat stock. The most popular form of pliers is the combination pattern shown beneath the socket wrench set. This is made of substantial drop forgings having a hinged joint that can be set so that a very wide opening at the jaws is possible. These can be used on round work and for wire cutting as well as for handling flat work.

A very complete set of files, including square, half round, mill, flat bastard, three-cornered and rat tail are also necessary. A hacksaw frame and a number of saws, some with fine teeth for tubing and others with coarser teeth for bar or solid stock, will be found almost indispensable. A complete punch and chisel set should be provided as shown at Fig. 19. A number of different forms and sizes of chisels are necessary, as one type is not suitable for all classes of work. The adjustable end wrenches can be used in many places where a monkey wrench cannot be fitted and where it will be difficult to use a wrench having a fixed opening.

The Stillson pipe wrench is useful in turning studs, round rods, and pipes that cannot be turned by any other means. A complete mechanic's shop kit must necessarily include various sizes of Stillson and monkey wrenches, as no one size can be expected to handle the wide ranges of work the professional workman must cope with, but the home mechanic will find an 8" size adequate for almost any work he will be called upon to do.

Two or three sizes of hammers should be provided,

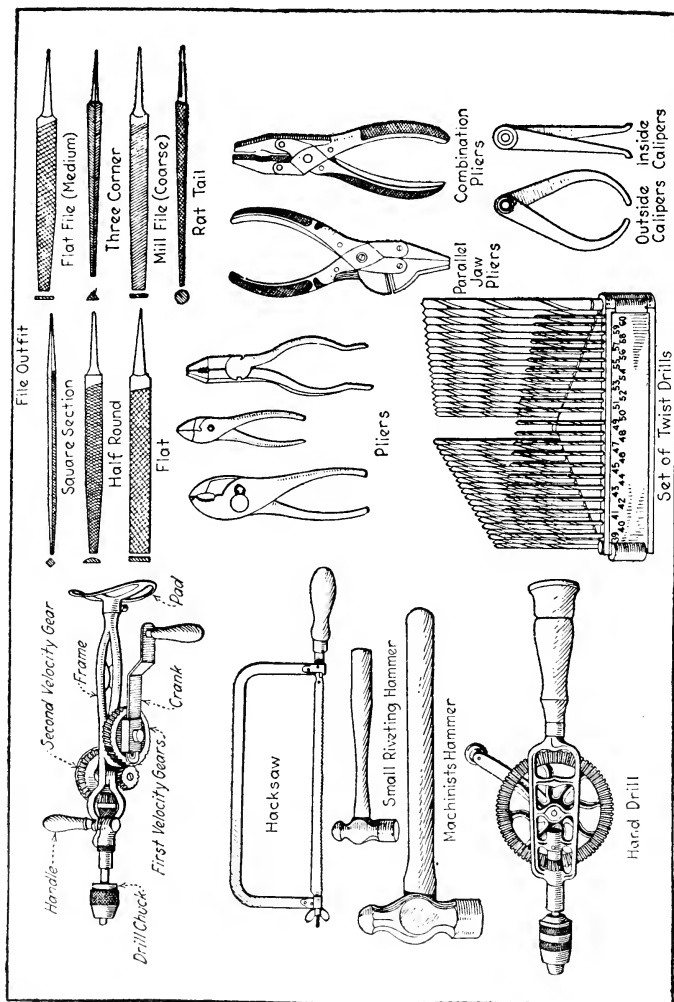


Fig. 18.—Metal Working Tools That Can Be Profitably Added to the Home Workshop Equipment.

according to individual requirement, these being small riveting, medium and heavy-weight machinists' hammers. A very practical tool of this nature for the home repair shop can be used as a hammer, screw-driver or tire iron. It is known as the "Spartan" hammer and is a tool steel drop forging in one piece having the working surfaces properly hardened and tempered while the method is distributed so as to give a good balance to the head and a comfortable grip to the handle. The hammer head provides a positive and comfortable T-handle when the tool is used as a screw-driver or tire iron. Machinists' hammers are provided with three types of heads, these being of various weights. That shown is the form most commonly used and is termed the "ball pein" on account of the shape of the portion used for riveting.

Mention has been previously made of the importance of providing a complete set of files and suitable handles. These should be of various grades and degrees of fineness and three sizes of each kind should be provided if a complete equipment is desired. In the flat and half round files three grades are necessary, one with coarse teeth for roughing, and others with medium and fine teeth for the finishing cuts. The round or rat tail file is necessary in filing out small holes, the half round for finishing the interior of large ones. Half round files are also well adapted for finishing surfaces of peculiar contour, such as the inside of bearing boxes, connecting rod and main bearing caps, etc. Square files are useful in finishing keyways or cleaning out burred splines, while the triangular section or three-cornered file is of value in cleaning out burred threads and sharp corners. Flat files are used on all plane surfaces.

A file brush consists of a large number of wire bristles attached to a substantial wood back having a

handle of convenient form so that the bristles may be drawn through the interstices between the teeth of the file to remove dirt and grease. If the teeth are filled with pieces of soft metal, such as solder or babbitt,

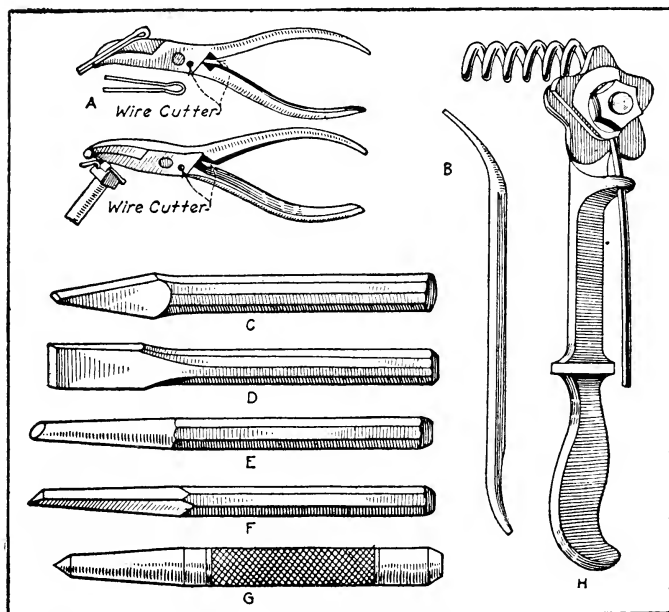


Fig. 19.—Cotter Pin Pliers Shown at A—Cotter Pin Extractor Shown at B—Chisel and Punch Set, C to G Inclusive—Spring Winder at H.

it may be necessary to remove this accumulation with a piece of sheet metal.

One of the most widely used of the locking means to prevent nuts or bolts from becoming loose is the simple split pin, sometimes called a "cotter pin." These can be handled very easily if the special pliers shown at Fig. 19, A, are used. These have a curved jaw that permits of grasping the pin firmly and insert-

ing it in the hole ready to receive it. It is not easy to insert these split pins by other means because the ends are usually spread out and it is hard to enter the pin in the hole. With the cotter pin pliers the ends may be brought close together, and as the plier jaws are small the pin may be easily pushed in place. Another use of this plier, also indicated, is to bend over the ends of the split pin in order to prevent it from falling out. To remove these pins a simple curved lever as shown at Fig. 19, B, is used. This has one end tapering to a point and is intended to be inserted in the eye of the cotter pin, the purchase offered by the handle permitting of ready removal of the pin after the ends have been closed by the cotter pin pliers.

A complete chisel set suitable for repair shop use is also shown at Fig. 19. The type at C is known as the "cape" chisel and has a narrow cutting point and is intended to chip keyways, remove metal out of corners and for all other work where the cutting edge chisel, shown at D, cannot be used. The form with the wide cutting edge is used in chipping, cutting sheet metal, etc. At E a round nose chisel used in making oil ways is outlined, while a similar tool having a pointed cutting edge and often used for the same purpose is shown at F. The centre punch depicted at G, is very useful for marking parts either for identification or for drilling. In addition to the chisels shown, a number of solid punches or drifts resembling very much that shown at E, except that the point is blunt, should be provided to drive out taper pins, bolts, rivets, and other fastenings of this nature. These should be provided in common sizes. A complete set of real value would start at $\frac{1}{8}$ " and increase by increments of $\frac{1}{32}$ " up to $\frac{1}{2}$ ". A simple spring winder is shown at Fig. 19, H, this making it possible for the repairman to wind coil springs, either on the lathe or

in the vise. It will handle a number of different sizes of wire and can be set to space the coils as desired.

Drilling machines for the home mechanic are usually hand-operated. For drilling small holes in metal it is necessary to run the drill fast, therefore the drill chuck is usually driven by gearing in order to produce high drill speed without turning the handle too fast. A small hand drill is shown at Fig. 18.

As will be observed, the chuck spindle is driven by a small bevel pinion, which in turn is operated by a large bevel gear turned by a crank. The gear ratio is such that one turn of the handle will turn the chuck five or six revolutions. A drill of this design is not suited for drills any larger than $\frac{1}{4}$ ". For use with drills ranging from $\frac{1}{8}$ " to $\frac{3}{8}$ ", or even $\frac{1}{2}$ " in diameter, a breast drill is required, this being a larger form of hand drill and is also illustrated at Fig. 17. A set of number drills suitable for the home mechanic's workshop, set in a metal base block, is shown at Fig. 18. This includes all sizes that are apt to be required in work about the home. A steel rule and inside and outside calipers are also of value.

Supplies for Home Workshop.—Without knowing the character of the work the home mechanic will attempt, it is not possible to give definite advice about the supplies that should be available. All of the material mentioned can be used at some time or other and can be purchased as required. In buying nails, screws, nuts and numerous small items of hardware, one can sometimes purchase a quantity for but little more than a few will cost. One can often secure a gross of screws in a box as cheaply as a few dozen counted out in an envelope. Always ascertain the cost of an unbroken package containing a small standard quantity before buying an odd

amount, which might result in breaking the package and cost fully as much.

The items of hardware most used in the home workshop are: wood screws, stove bolts, nails, brads, tacks, both carpet and curtain; escutcheon pins, small rivets, screw-eyes and screw-hooks in both steel and brass and various sizes; a few sizes of nuts and bolts, iron washers, split pins, hose clamps, wire solder, picture hangers' wire, spool of bare copper wire about No. 16, and a coil of soft iron wire of the same size. Lag screws and upholsterers' tacks will be needed if furniture is made or repaired. Both emery cloth and sand paper in various grades should be stocked. Electrical tape can be used for many purposes besides that of insulation and a roll should always be handy.

A number of paints and chemicals will also be useful. Some carbon tetrachloride for cleaning purposes; white and orange shellac; alcohol; stove pipe black; enamels and paints as required; turpentine and linseed oil; aluminum and bronze powder, banana oil lacquer, glue for wood; rubber cement, putty, asbestos cement, beeswax and rosin, potash, or lye; machine oil; 3 in 1 oil; furniture polish; wood stains and furniture wax; white or red lead; Smooth-on cement for metal, and ample supplies of waste and cleaning rags.

A fireproof receptacle should be provided for wood shavings, dirty cloths, oily waste and other inflammable material. A small galvanized iron can, such as used for garbage, is very good for this purpose. The hinged cover keeps the contents inside the can and there is no danger of fire. A push broom, a dust pan, and a bench brush will also help in keeping the shop clean and make it a pleasant place to work in.

CHAPTER II

SPECIAL TOOLS AND SHOP EXPEDIENTS

Two-foot Rule for Laying Out Angles—Lamps for Fine Soldering—Soldering—Iron Heater—Non-Spilling Acid Cup—Home-Made Blow Torch—Improved Tools—Wooden Hacksaw Frame—Cabinet Scraper Handle—Inexpensive Marking Gauge—Stunts With Hammers—Soft Faced Hammer—Wedging Hammer Handles Securely—Stowing Away the Nail Set—Repairing Cracked Hammer Handle—Emergency Wrench for Turning Pipe—Kink for Sharpening Skates—Small Jaws for Holding Screws—Home-Made Expanding Bolt—Insulating Plier Handles—Use of Drill Gauge—Removing Stud Bolts—Simple Saw Clamp—Extemporized Sawing Gauge—Repairing Wood Boring Bits—Screw Inserting Tool—Soldering Iron Kinks—Simple Pipe Wrench—Using Wrench for Pipe Cutting—Suggestions for the Home Painter—Simple Paint Brush Wiper—Keeping Brush Handle Clean—Handle Hook—Extension Handle for Brush.

The special tools and simple devices described in this chapter cannot fail to be of value to the home mechanic who must often extemporize ways of doing things with the ordinary tools in his equipment, whereas the professional always has special tools for the work in hand. All of the suggestions which follow have been tried by handy men and have been found useful in shop work and around the home.

Two-Foot Rule for Laying Out Angles.—If it is desired to lay out angles and a protractor is not available, it is possible for the handy man to use a 2' rule for this purpose and secure fairly accurate results if he refers to the table given at Fig. 20. In operation

the rule is opened varying amounts depending on the angle desired and the distance is measured between the edges of the rule. For example, if one wished to lay out a 15° angle, by consulting the table it will be found that the distance is $3\frac{1}{8}"$. Similarly a 30° angle could be obtained by spreading the ends of the folded rule $6\text{-}7/32"$. Distances given are accurate within $1/32"$, and are believed to be sufficiently accurate for practical use. The only way to obtain angles accurately is by using a protractor.

Lamps for Fine Soldering.—A very simple alcohol lamp is shown at Fig. 21, A. This is made by cutting a tube from the brush of an old mucilage bottle and by threading some cotton wicking down through the tube. Any piece of copper or brass tube of suitable size may be used if desired. A cork is selected that will fit the bottle tightly and the end of the tube passed through it so that the lower portion of the wicking will project into the alcohol. In order to prevent evaporation the outer end of the wick should be covered with some form of tubular member such as an old cartridge shell. Another simply made spirit lamp is shown at B. This is contrived from an old spring bottom oil can, the spout of which is cut up close to the can body and wicking passed through it as indicated. Either of these alcohol lamps can be used if doing small soldering jobs, and for heating small irons.

Soldering Iron Heater.—It is possible to use ordinary pipe fittings and make a somewhat more pretentious soldering iron heater as shown at Fig. 21, C. The main part is composed of a $12"$ piece of $\frac{1}{2}"$ iron pipe provided with threads at each end on which ordinary pipe caps are screwed. A series of holes $1/16"$ in diameter and in two or three rows is drilled to extend about $4"$ from one end. At the other end a small piece of the pipe is cut out to form a rectangular open-

ing through which air can come and mix with the gas. Pieces are cut from sheet metal to form legs as indicated, these being provided with a hole through which pipe is passed and are extended up above the pipe sufficiently high to form a rest for the soldering iron. A nozzle for the gas burner is made of a piece of $\frac{1}{8}$ "

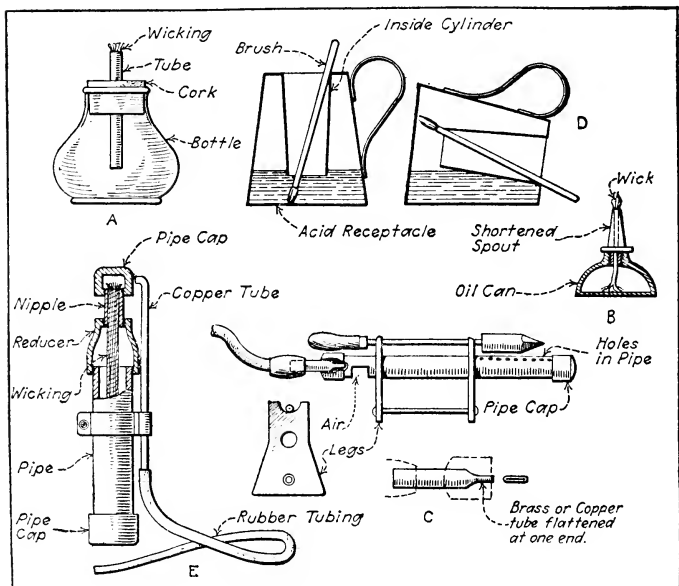


Fig. 21.—Alcohol Lamps, Acid Receptacle, Blow Torch and Soldering Iron Heater May All Be Made in the Home Workshop.

pipe about 4" long which is flattened at one end as indicated. This is inserted into the cap at the end of the pipe opposite the drilled holes through a hole provided for that purpose in the cap. The pipe should be a tight fit in the end of the cap and should be moved back and forth until the proper flame is obtained at the other end of the pipe. It is connected to the city

gas supply by means of the usual rubber gas tube. If the flame is too red or yellow, which indicates too much gas, the end of the small pipe may be flattened more to restrict the amount of gas supply to the mixture to be burned. When the parts are properly adjusted, a series of blue flames such as in a gas stove will result when the gas and air mixture issuing from the small holes is ignited.

Non-Spilling Acid Cup.—A receptacle for soldering acid that will not spill its contents out even if tipped over is shown at Fig. 21, D. This is a double cup which has an inside cylinder to form a partition to keep the acid from leaking out if the container is lying on its side. A very good size is to make the main cup about 3" high with a diameter at the bottom of 2" and at the top of 1½". The inside cylinder in which a brush is inserted may be 1" in diameter at the top tapering down to ¾" at the lower end. The inner cylinder is joined to the outer cup by a flat ring of metal securely soldered to both cup and top of cylinder. The handle shown may be added as a convenience but is not absolutely necessary. This is made of a piece of strip stock riveted to the cup before the parts are assembled. In order to prevent leakage of acid the riveted points should be well soldered. Copper is very good material for making a soldering acid cup as shown.

Home-Made Blow Torch.—Many useful devices may be made of pipe fittings by the home mechanic. The blow torch which is shown at Fig. 21, E, is of substantial construction and will give very good results. A 1" pipe nipple 6" long is fitted with a reducing coupling at one end and a pipe cap at the other. A ½" pipe nipple 1½" long is screwed into a reducer at one end and is provided with a suitable cap at the other. The wick is made by bunching a sufficient number of strands of lamp cord or candle wicking to fill a ½"

pipe nipple and to extend from one end of that member down into the body of the torch. The blow pipe is made of a piece of copper tube about 8" long bent over at the top and attached to the reservoir by a simple sheet metal clamp. A couple of feet of rubber tube is attached to the lower end of the blow pipe tube.

The pipe cap at the top keeps the alcohol, with which the container is filled, from evaporating and should always be screwed on when the lamp is not in use. If a brass pipe is employed to form the reservoir, the lower cap may be soldered to prevent leakage. If iron pipe is used a paste of red lead and glycerine may be applied to the threads of the cap before it is screwed in place. The method of using a torch of this kind is very simple. The wick is lit as in any alcohol lamp and air is blown through the rubber tube which is placed in the mouth of the operator to direct the flame to the point it is desired to heat.

Improvised Tools.—It often happens that one is in need of a compass for scribing circles and a compass is not available. If one has a pencil it is not difficult to contrive a satisfactory substitute by taking a length of steel wire and winding several coils around the pencil body as shown at Fig. 22, A. The lower end of the wire is sharpened to a point and circles of varying radius may be made by bending the wire to obtain the desired distance between the pencil point and that of the wire.

In cutting sheet metal that is too heavy to be cut with the ordinary tin snips held in the hand or for cutting irregular shapes where the sheet of metal must be manipulated, much better results are obtained if the snips are held between the vise jaws as indicated at Fig. 22, B, as more pressure can be exerted on the one movable blade than when they are held in the

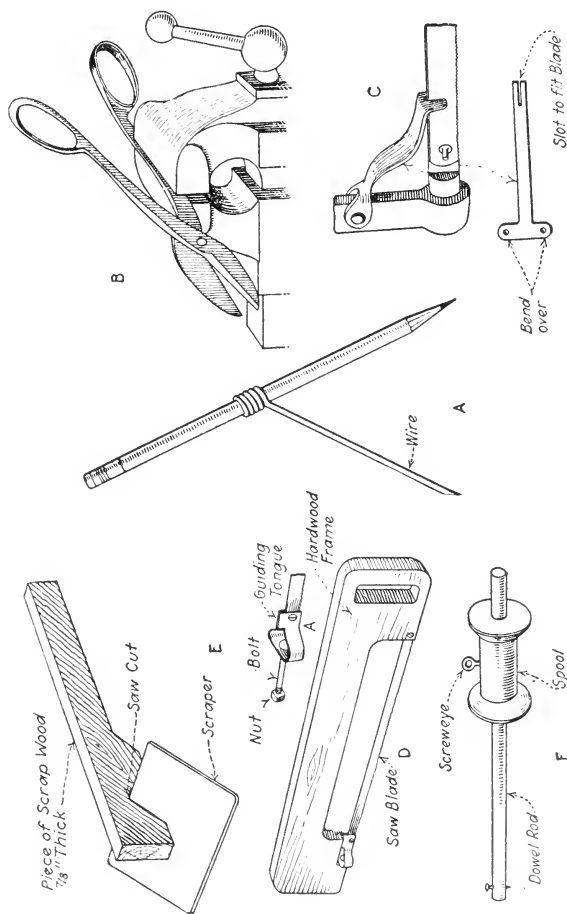


Fig. 22.—A—Extemporized Pencil Compass. B—How Tin Snips Can Cut Heavy Gauge Metal. C—Simple Thumb Rest for Hacksaw. D—Home-Made Hacksaw Frame. E—Cabinet Scraper Handle. F—Economical Scratch Gauge.

hand and both blades have pressure exerted to close them.

If one has a large number of pieces of metal to saw with ordinary hacksaw, considerable discomfort may result from the cramped position of the thumb which imparts pressure to the end of the hacksaw frame opposite the handle and which is necessary not only to feed the saw into the piece cut but also to steady it. A simple thumb rest may be made of sheet metal as shown at Fig. 22, C. The metal must be of sufficiently heavy gauge not to lose its shape when pressure is applied. It is supported at the front end by a hinge at the hacksaw frame and is slotted at the other so that it will bridge the sawblade and not slip off. The slot is made so that it will fit the hacksaw blade accurately and thus it provides a stiffening effect that is valuable in sawing certain metals. The method of application and the development of this piece before it is bent is clearly shown at Fig. 22, C. The reason it is attached to the frame is so that it will not be misplaced and so it can be swung out of the way when blades are changed.

Wooden Hacksaw Frame.—While hacksaw frames are not expensive and may be purchased at a hardware store for comparatively little money, the handy man may desire to make his own sawframe, which he can easily do by following the design sketch given at Fig. 22, D. The frame is made of hard wood and a slot is provided at both ends of the arch to receive the end of the blade or the guiding fin of the tension fitting. A cotter pin or small bolt serves to hold the end of the hacksaw blade near the handle. The other end of the blade is supported by a bent metal clip which is provided with a bolt passing through the wooden handle and having a nut at its outer end by which the blade may be tightened by pulling the

tension member closer to the frame end. The blade is kept from turning by a projecting feather that sticks up into the slot cut above the tension fitting.

Cabinet Scraper Handle.—Another tool that may be easily improvised is a handle for a steel plate cabinet scraper as shown at Fig. 22, E. Any piece of scrap hardwood may be utilized, cut approximately to the shape outlined and a saw cut made on an angle to fit the scraper steel tightly. This makes it considerably easier to handle the thin scraper blade than when held in the hand.

Inexpensive Marking Gauge.—A very simple and effective marking gauge may be made at slight expense as shown at Fig. 22, F. A piece of dowel rod or a round stick is whittled out and dressed down so that it will fit the hole in a large spool tightly. A small brad is driven part way through one end so that its point projects through about $\frac{3}{32}$ nds of an inch. The adjustment of the gauge is easily accomplished by moving the spool as desired on the tightly fitting round stick of wood. Another way is to use a screweye as a clamp screw which is screwed into the spool, but which has a flattened end so that it will not cut into the central rod. When this is done the spool need not fit tightly. If desired, a small piece of steel or brass rod may be used instead of the wooden piece in which case a hole will have to be drilled at one end in which a suitable metal point is placed.

Stunts With Hammers.—The ordinary claw hammer, which is such an indispensable tool in the home workshop is not suitable for pulling tacks or very small brads. The simple expedient of filing a notch in one of the claws as indicated at Fig. 23, A, adapts it perfectly for pulling out small tacks and makes the use of a separate tack puller unnecessary.

Soft Faced Hammer or Mallet.—For working on polished metal surfaces or finished wood pieces, or for driving out threaded members such as bolts without marring the threads, a soft faced hammer may be contrived as shown at Fig. 23, B. A piece of iron pipe about $1\frac{1}{2}$ " in diameter and 3" long forms a basis of this tool. Two holes are drilled through close to each other and then filed square so that an ordinary hammer handle may be wedged in. The soft faces

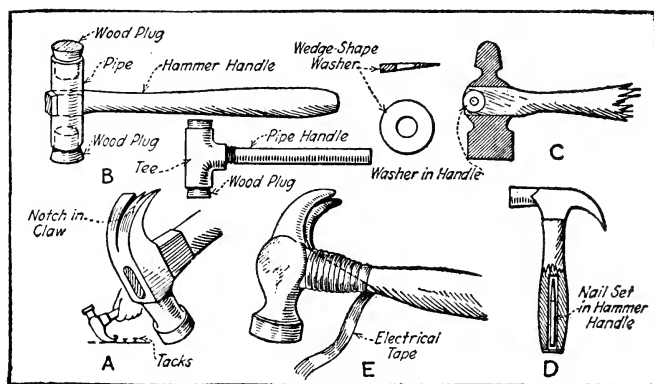


Fig. 23.—Stunts With Hammers.

are made of soft wood plugs tapered so they may be driven into the ends of the pipe. When the plugs become worn they may be easily replaced at slight expense. By using a short piece of wood several inches in diameter and 3" long and drilling a hole in the center for a handle, it is not difficult to make a mallet that will prove useful on different kinds of woodwork.

Wedging Hammer Handles Securely.—There is nothing more annoying than to have a loose hammer head on a handle. The ordinary forms of simple wood or iron wedges do not always stay in place, which is

the main cause of the looseness. An expedient that is recommended is to take an iron washer that will fit into the eye of the hammer and grind it wedge shape as shown at Fig. 23, C. After the wedge is driven in place part of the wood of the handle will swell into the opening in the washer and the wedge thus made will remain firmly in place. A washer larger than the eye of the hammer may be used by grinding off two points on the circumference to obtain flat pieces and thus reduce the washer diameter. An ordinary metal wedge may be used by drilling the hole through it, but a washer is recommended because these are usually available, and as they are made of soft iron they may be filed tapering if an emery wheel is not available for grinding it down.

Stowing Away the Nail Set.—Where much nailing is to be done it is not always easy to keep the nail set handy as this is a small tool that is easily misplaced and so shaped it may roll off the bench on the slightest provocation. The sketch at B, Fig. 23, shows a simple expedient for carrying the nail set so it will not be lost and will be available when wanted. A hole slightly larger in diameter than the nail set and about $\frac{1}{8}$ " longer is drilled into the end of the hammer handle. A small plate held by a screw serves as a cover to keep the nail set from falling out and can be swung to one side when the nail set is needed.

Repairing Cracked Hammer Handle.—Hammer handles sometimes break off near the head, especially if the hammer is used for work it is not designed for, such as trying to pull out spikes or using the hammer head or handle as a pry. Sometimes the handle does not break off, but cracks. In this case the fractured portion may be tightly wound with electricians' tape which reinforces the weakened portion. Some mechanics have wound closely spaced copper wire coils

tightly around the cracked portion and extending beyond the break. In order to keep the copper wire in place it is soldered, and then it becomes a solid metal sleeve that is a very effective reinforcement for the weak handle.

Emergency Wrench for Turning Pipe.—The home workshop cannot be expected to contain the assortment of tools that is found in professional establishments. Sometimes it is necessary to turn pieces of pipe or other round objects that are beyond the capacity of the Stillson wrench or pipe pliers in the home tool kit. In this case the expedient outlined at Fig. 24 provides a very good form of pipe wrench. A pipe tee and a foot or more of pipe forms the basis of the tool and a piece of chain which is wound around the pipe and passed through the tee piece as indicated will give a very firm grip on the pipe.

Kink for Sharpening Skates.—The home mechanic is often called upon to sharpen skates. It is not difficult to dress the blades down flat, but it is hard to produce the hollow ground effect unless one is wise to the kink depicted at Fig. 24, B. A simple guide clip is made of sheet metal so that the round file used in hollowing the skate blade is guided and cannot slip off. The guide clip is moved back and forth with the file. This method can only be employed on the cheaper grade of skates that have soft steel blades. Higher grade skates have harder steel surfaces that can only be machined by means of an emery wheel or oilstone.

Small Jaws for Holding Screws.—Inexpensive jaws to be used in a small bench vise for holding screws for slotting or for filing down the ends of the thread without injuring the threaded surface may be readily made by sawing through a nut that will fit the screw and filing a ledge so that the nut will drop through

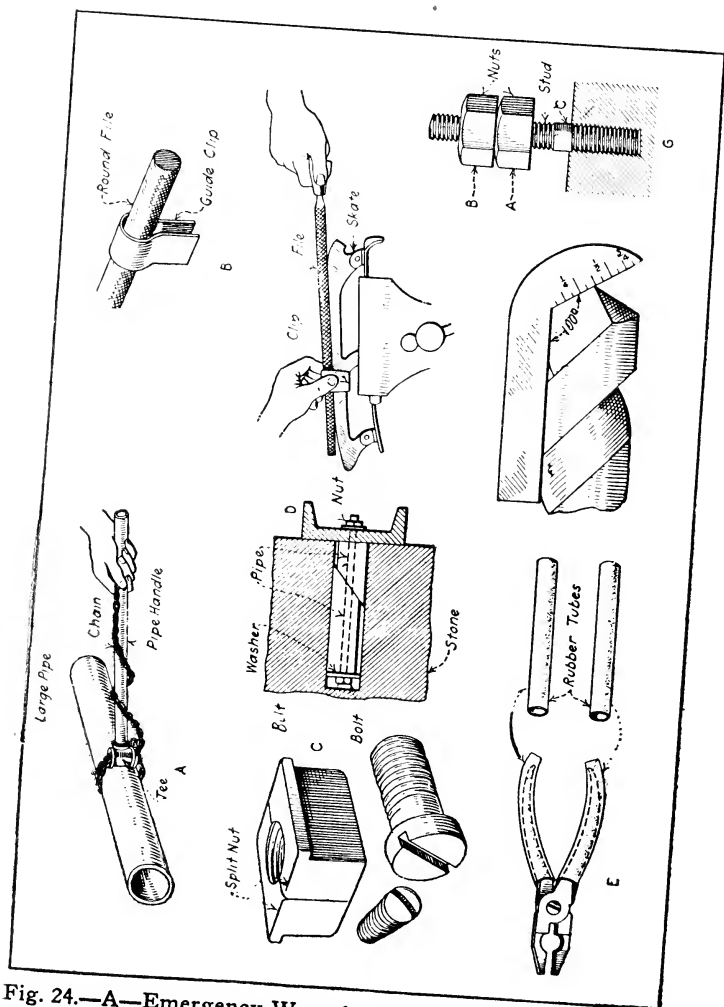


Fig. 24.—A—Emergency Wrench for Unscrewing Large Pipe. B—How to File Skate Blades Concave. C—Vise Jaw for Holding Screws Without Marring Threads. D—Simple Expansion Bolt. E—Insulated Handle Pliers. F—Use of Drill Gauge. G—How to Remove Stud Bolt.

the vise while it is being tightened. Small screws may be held by nuts that are not slotted all the way through but only through one side. It will be evident that the screws will be very firmly held without any injury to the threads.

Home Made Expanding Bolt.—In fastening objects to brick walls or other masonry, expansion bolts are necessary because it is not possible to thread such materials and wooden plugs driven in holes drilled do not always provide a strong enough anchorage. A simple method of making an expansion bolt is outlined at Fig. 24, D. A short piece of gas pipe of the required diameter and length is divided by a slanting cut made with a hacksaw. The bolt is passed through the center and as the nut is tightened up, the tapering ends of the pipe slide on each other, which increases the effective diameter of the pipe at that point, causing it to clamp firmly against the material at the sides of the hole because of its expanded diameter.

Insulating Plier Handles.—In working around wires comprising electrical circuits, especially if these carry lighting or power current, the workman will find insulated plier handles useful. While pliers with very good handles may be obtained from hardware stores in which an insulating composition is vulcanized to the metal, the home workshop can be supplied with a very satisfactory substitute. As shown at Fig. 24, E, pieces of rubber hose or tube are cut to correspond to the length of the handles and forced over them as indicated. This makes a very satisfactory insulation that will resist ordinary voltages used for power and lighting circuits.

Use of Drill Gauge.—Grinding a twist drill so that it will cut well and to size is not a difficult proposition if a drill grinding gauge such as shown at Fig. 24, F, is used. This insures that both lips of the drill will

be ground to the same angle as the gauge and that both lips will measure the same. If one of the lips is ground at a different angle than the other or is longer, the drill will not feed freely into the metal and will make an over-sized hole. The angle generally adopted for drill lips is approximately 100 degrees.

Removing Stud Bolts.—A very simple method of removing stud bolts is shown at Fig. 24, G. This is much better than the usual method of using pipe pliers or a Stillson wrench on either the body or the threaded part. Two nuts are used, one to lock the other firmly on the thread and keep it from coming off. The stud is unscrewed by applying a wrench to one of the nuts while the other is kept firmly seated against it by another wrench.

Simple Saw Clamp.—A very simple saw clamp that can be used advantageously if it is necessary to sharpen the saw teeth and no regular clamp is available may be made as shown at Fig. 25, A. In this a piece of board or timber is ripped for a depth of half that of the saw blade and then the saw is dropped into this groove. As the groove is larger than the gauge of the saw blade it is necessary to clamp that member by driving small wedges or slivers of wood between the blade and the wood at one side of the slot. This expedient enables one to hold a saw at such a height above the bench as will permit easy and accurate filing, which is not always possible if the saw is placed in a bench vise, which is usually too low for the purpose.

Extemporized Sawing Gauge.—A workman who had several trestles to make and no miter box handy extemporized a miter cutting gauge that proved to be very satisfactory as shown at Fig. 25, B. Ordinarily it would have been necessary to lay out an angle on each leg separately as a guide for sawing, but with

the miter box that was contrived on the job, it was possible to cut all the legs accurately and at the same angle. The base angle was made of stock the same thickness as that used for the legs. Three pieces of $\frac{7}{8}$ " board were nailed to this base piece in such a position as to guide the saw at the proper angle for cutting the miter. A nail driven in one of the upright pieces to act as a stop and the single piece at the other end of the base member formed a useful gauge for cutting the legs to the correct length

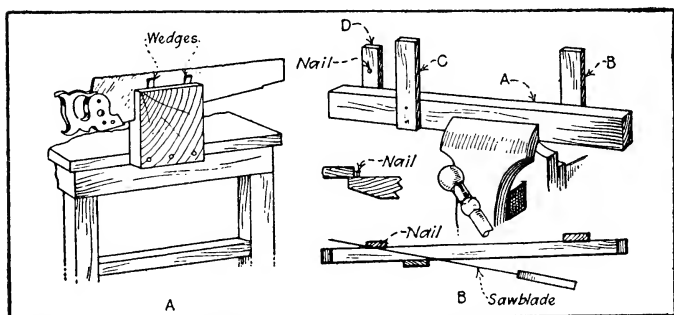


Fig. 25.—Simple Saw Clamp at A. B—Gauge for Sawing Trestle Legs.

as well as holding the legs steady while being sawed. The positions of the guide pieces may be changed to suit the requirements and the suggestion given can be employed to advantage by the home mechanic whenever a number of duplicate pieces are to be sawed.

Repairing Wood Boring Bits.—When the spurs on wood boring bits cut the hole smaller than the size of the twisted portion, as results when they become bent in, it is easy to restore them to the normal cutting position in the manner shown at Fig. 26, A. A small nail set or light punch is used to drive the spurs

back in line. In order to do this, the bit is placed on a level surface and the spurs driven out by blows from a light hammer so that it will be a little wider apart than the diameter of the twisted part of the bit. Both spur points should be the same distance away from the center screw point. If the lips become dull, they may be dressed down with a fine file or small oil stone, the center screw may be sharpened with a small three cornered file.

Screw Inserting Tool.—When fussing around on small work as in clock repairing or tinkering with a sewing machine, and even on auto repairing, it is sometimes necessary to insert small screws that are difficult to hold with the hand and leave room enough to work a screwdriver. The tool shown at Fig. 26, B, greatly facilitates this work. It may be made in various sizes, depending on the screws to be handled. The end of the tool, which is made like a screwdriver, is slotted, so that it may be sprung into the slot in the screw head. After the screw is started the ordinary screwdriver can be employed to finish the job.

Soldering Iron Kinks.—When it is necessary to do soldering in spaces where the ordinary pyramidical soldering iron as shown at C, Fig. 26, cannot be used to advantage, the special shape depicted at D will be found valuable. One side is absolutely flat, while the other three sides taper to a point as in the usual construction. The advantage of this shape is that it permits of heating seams better than the usual form on account of the greater area of the iron in contact with the metal to be heated and also because more of the tinned surface of the iron is in contact with the portion to be soldered.

A simple expedient to keep a hot soldering iron from burning a wooden benchtop is shown at Fig. 26, C. The large iron washer or disc of metal with a

hole drilled through serves as a rest to keep the soldering copper head away from the wood. This washer, being a loose fit on the shank, can be slipped back to the handle when the iron is heated or when it is in use.

Simple Pipe Wrench.—An ordinary monkey wrench may be changed to a pipe wrench by providing an

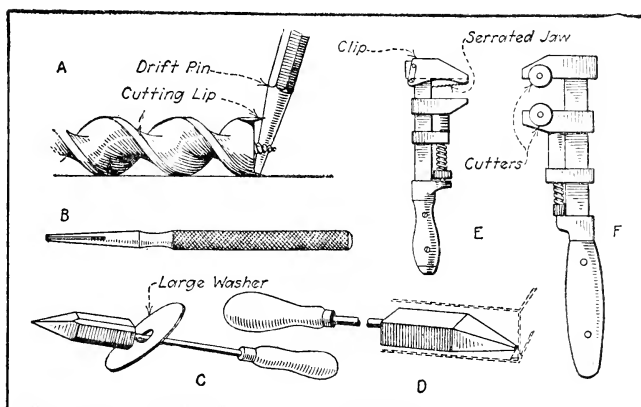


Fig. 26.—A—How to Repair Wood Bit. B—Screw Holder. C—Keeping Hot Soldering Iron Away From Bench Top. D—Special Shape Iron for Flat Work. E—Jaw to Make Pipe Wrench Out of Monkey Wrench. F—Converting Wrench to Pipe Cutter.

easily made serrated jaw which is held in place against the movable end jaw by a spring clip. When not in use as a pipe wrench, the toothed piece and its holding clip may be removed and the wrench used in the usual manner.

Using Wrench for Pipe Cutting.—A large wrench may be fitted with a pair of hardened steel cutters as shown at Fig. 26, F, so it becomes a pipe cutter that can be used very well in an emergency. The discs

are held in place by pins or bolts which fit in the suitable holes drilled into the wrench jaws. These holes do not materially weaken the wrench and if the discs are held on by bolts they may be removed if it is desired to employ the wrench for its legitimate purpose.

Suggestions for the Home Painter.—When engaged on outside work the painter often finds it necessary to hang his paint can from the rung of a ladder. This

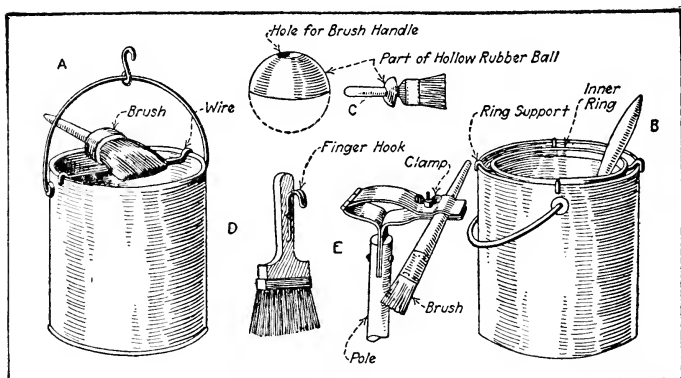


Fig. 27.—Hints for the Home Painter.

may be easily done by bending up a simple hook of "S" shape of about $\frac{3}{16}$ " cold rolled steel rod as shown at Fig. 27, A. Another simple device easily made of the same material and also illustrated is a piece of wire having hooks on each end to engage the sides, that will fit across the pail. It will be observed that the brush may be laid on this support which eliminates placing it at some point where it might accumulate dirt when it is desired to move the ladder from point to point. Another advantage of this wire is that it may be used for wiping off surplus paint from the brush.

Simple Paint Brush Wiper.—Another idea for keeping the outside of the bucket clear of paint is shown at Fig. 27, B. If practice is made of wiping a brush off against the side of the can, while most of the paint flows down on the inside, a certain amount always runs down on the outside. This makes a very dirty can. The paint brush drainer shown is extremely simple, consisting of a piece of sheet metal bent in the form of a circle about $1\frac{1}{2}$ " smaller in diameter than the opening of the pail. Hooks of steel wire are made and attached to the ring by solder. These serve to support the ring and locate it concentrically with the outside of the pail. All the paint drained off the brush will fall into the can and the outside will be kept clean.

Keeping Brush Handles Clean.—When painting overhead it is hard for the unpracticed mechanic to use just such quantities of paint as are necessary and any surplus is apt to run down on the paint brush handle and to the hand holding the brush. The kink shown at Fig. 27, C, will prevent this. An ordinary hollow rubber ball is cut in half and a hole is made to receive the paint brush handle. The hole should be made smaller than the handle so that the rubber will constrict around that part of the brush and keep the half ball firmly in place. When this is fitted any paint that would tend to run down on the handle will collect in the cup formed by the semi-spherical rubber member.

Handle Hook.—A simple hook that can be attached to a paint brush handle, so that member can be hung to the side of the paint pail, is outlined at Fig. 27, D. This wire hook also provides a good hand hold and keeps the brush from slipping out of the grasp. A piece of wire about $\frac{1}{8}$ " in diameter is bent to the shape indicated and the ends may be pointed and

driven into the wood or holes may be drilled through the brush handle, the wire ends pushed through and bent over on the opposite side to keep the hook in place. When a hook of this kind is fitted, the brush is held in the usual manner and is braced by passing the hook between two of the fingers.

Extension Handle for Brush.—When it is desired to do a little touching up at points that cannot be conveniently reached even with a ladder, a simple extension fitting may be made out of an old bicycle lamp bracket for grasping the handle of the paint brush. An old broom handle or similar stick may be slotted at one end to receive a portion of the clamp which is held in place by a small bolt passing through the assembly. As will be apparent even if an old lamp bracket is not available the clamp member may be easily made by bending up sheet brass or other metal to the approximate form shown. The advantage of this fitting over the usual method of tying the handle of the brush on the end of a stick is that it is much easier to change paint brushes if different colors are to be applied and the brush is held firmly, which is necessary to secure good work.

CHAPTER III

USEFUL HOME APPLIANCES

Keeping Ladder from Slipping—Practical Ladder Extension—Easy Rest for Feet—Metal Scaffold Bracket—An Intermediate Ladder Step—Using One Lock for Three Drawers—Double Bolt for Door—Secure Locking Means—Furnace Door Opener—Furnace Door Stop—Automatic Draft Opening Means—Broom Hanger—Skirt or Pants Hanger—Easily Made Door Spring—An Economical Door Stop—Useful Kitchen Appliances—Easily Made Pan Cover—Holder for Milk Bottles—Drinking Glass Holders—Keeping Spoon Out of Kettle—Home Water Works—Garden Hose Repair—Keeping Hose Packing Washers in Place—Repairing Leaky Faucet—Home-Made Hose Reel—Useful Hand Trucks—Package Carrier for Bicycles—Picture Frame Hanging Made Easy—Metal Corners From Tubing—How to Fasten Floor Boards—Making Wood Screws Tight—Raising a Sagging Door—Efficient Cord Cutter—Locating Drain Pan—Preventing Splash of Waste Water—Cleaning Dirt Out of Corners—Combined Broom and Ice Pick—Sleeve Pressing Board—Ironing Board Support—Shoe Polishing Stand—Indoor Clothes Hanger—Improving Linen Closets—Storing Kettles and Pans—Trouser Hanger for Closet—Installing Curtain Pole—Using Electric Flat Iron for Stove—Range Boiler Repairs—Cheap Candle Lamp—Keeping Soot in Stove Pipe—Clipping Trees Without a Ladder—Doubling Capacity of Spring Balance—Simple Magazine Rack—Cabinet for Woodworking Tools.

The home mechanic prides himself in being able to make many appliances and devices that will make housekeeping easier or that will make the many necessary tasks about the home less difficult. The appliances described in this chapter range from simple devices that may be bent up out of a few inches of

wire in a few minutes to examples of cabinet or joiner work that will furnish occupation for a number of spare hours. All of the suggestions given are adapted to the home and shop and should be of value for that reason. The handy man who cannot apply many of the suggestions given will indeed be hard to suit.

Keeping Ladder From Slipping.—Serious accidents often result when the bottom of a ladder of the ordinary type slips on the ground or floor due to being placed at too gradual an angle. A simple method of eliminating this when the ladder is used on smooth floors of either wood or other material is to employ a combination pad at the foot of each ladder side as indicated at Fig. 28, A. This combines a sharp pointed spike and a rubber pad so that it will hold on a large variety of floor surfaces. The retaining fitting for the ladder foot is easily made by taking a piece of band iron and bending it up to the shape shown in the illustration so that it forms one member of a substantial hinge. It is then securely fastened to the bottom of the ladder by means of wood screws.

The foot pad is provided with two band iron lugs having a hole through them so that a bolt can be inserted to keep the ladder foot in position which are attached to the wood blocks by suitable screws. The spikes may be made by screwing the proper size wood screws into the wood from the top so they will project through the bottom the required distance. The rubber pad may be extemporized from old or new rubber heels on heavy ladders or by using the rubber knobs that may be obtained at a hardware store and that are intended for use on chair legs or as crutch tips. If the ladder is a light one, one wood screw and chair leg tip will be enough. If it is a heavy ladder it may be necessary to use a series of 4 or 5 screws and 2 or 3 rubber pads in each foot block.

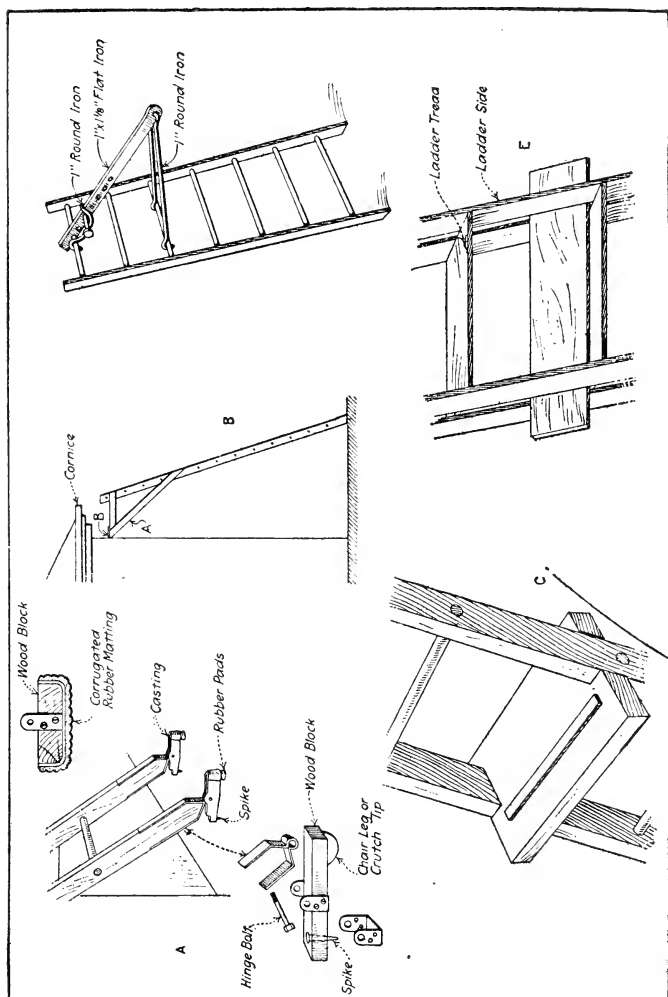


Fig. 28.—Suggestions for Users of Ladders in the Home or Shop.

When a ladder is to be used on polished floors where the spike method would result in damaging the polished surfaces, the bottom of the wood block may be covered with a piece of corrugated rubber matting. It will be evident that the hinge method of retention permits the pad to accommodate itself to various angles of inclination of the ladder or to differences in footing where the ladder is used. Such a device may be easily made by the handy man and will prove of considerable value as an accessory to any ladder used around the shop or home.

Practical Ladder Extension.—A ladder is sometimes too short to reach over a cornice, in which case it is possible to provide an extension as shown at Fig. 28, B, so that the roof may be reached even with a short ladder. The extension pieces are made of $\frac{7}{8}$ " stock and of the proper length to form the "V" brace member desired. One of these is securely nailed to each side of the ladder and a cross brace is nailed at the other end to keep them from spreading.

Easy Rest for Feet.—When one is not used to standing on the round rungs of a ladder for a long time, as is sometimes necessary in painting, a flat step may be easily made that will provide a much more easy rest for the feet. This may be made as shown at Fig. 28, C. It is formed of a piece of plank $1\frac{1}{2}$ " thick, 8" or 9" wide and as long as the ladder is wide and then cutting a piece out of it so that the ends will fit the ladder sides. The notches should be cut on an angle so that the board will be approximately level even when the ladder is inclined. The plank may be readily put in position by sliding it in the rectangular space between the two rungs, one end being near the lower rung and the other near the upper one on the opposite side. By dropping the high end of the step, it will fit against the sides of

the ladder snugly. Care should be taken to select a piece of wood for this that is sufficiently thick so that it will not split in half due to the weight of the person using the ladder. With an arrangement of this kind the plank may be changed from rung to rung as desired.

Metal Scaffold Bracket.—The scaffold bracket shown at Fig. 28, D, is a good suggestion for the workman who has to use ladders in his business. It is made of flat iron bar and bent round iron bar pieces. A series of holes is drilled in the flat piece so that it may be adjusted for various degrees of inclination or "slant" of the ladder and the construction is such that the bracket may be used for low work if placed on the inside of the ladder or for high work if installed on the outside. The scaffold planks are rested on the 1" round iron bars. Two inch by $\frac{1}{4}$ " bar stock and $\frac{3}{4}$ " or 1" round iron bar are the materials used and the attachment may be made at relatively small cost by any blacksmith from the sketch.

An Intermediate Ladder Step.—It sometimes happens that the spacing of the rungs of a step-ladder are either too high or too low to work comfortably when doing work on a wall or ceiling, such as washing windows or painting. A temporary expedient is to take a piece of board 4" to 6" in width and place it between the two side pieces of the step-ladder as shown at Fig. 28, E.

Using One Lock for Three Drawers.—When it is desired to lock a number of drawers by using one padlock, a very simple method of accomplishing this, such as shown at Fig. 29, A, may be used. The ordinary form of hasp and staple is employed, the hasp being attached to the drawer fronts while the staples are driven into the side of the cabinet so that the hasp will fit over it. An ordinary cold rolled round

rod has a ring formed at one end of approximately the same size as the staple and is sufficiently long so it will pass through the three staples as shown. A single locking member will serve to keep the rod in

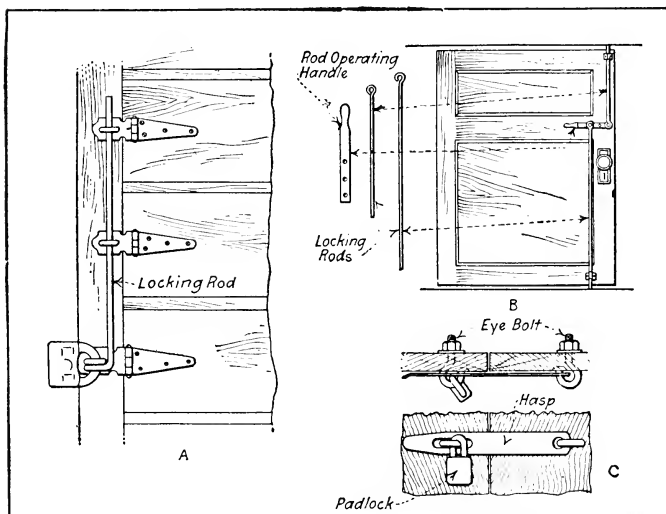


Fig. 29.—Method of Locking Three Drawers With One Padlock Outlined at A. B—Easily Made Double Bolt for Door. C—Secure Hasp and Padlock Fastenings.

place against the lower staple as indicated and all three drawers are prevented from opening.

Double Bolt for Door.—The double bolt for a door may be easily made by following the suggestions outlined at Fig. 29, B. This makes a method of locking from the inside that cannot be opened from the outside and is especially good for doors of storage sheds or stores that are located in an alley or at the back end where they cannot be easily kept under surveillance. The handle is formed of a piece of flat iron

about 1" x $\frac{1}{8}$ " of suitable length and has three holes drilled through it about 3" apart from one end. Two iron rods are cut so that their aggregate length is about 4" more than the length of the door. An eye is made in the end of each rod, which is then attached to the handle as indicated by means of bolts or rivets. A bolt or lag screw is used as a bearing for the handle, this support coming between the two holes to which the locking bolt rods are attached.

The lower ends of the rod are guided by band iron clips attached to the door by substantial screws. If the door is a high one it may be necessary to guide the locking bolts at an intermediate point as well as the bottom, but this will not be needed ordinarily. Holes to receive the bolts are drilled in the door frame at the top and bottom if the construction permits and it is well to protect the wood around the holes with metal plates screwed to the frame and having a hole in the middle to register with that bored into the door frame. On some other constructions it may not be possible to provide that system of anchoring the bolt rod ends. In such cases, a simple angle bracket that may be fastened above the door will serve as a receptacle for the bolt end. No difficulty will be experienced with the bottom bolt because it will always be possible to make a hole in the door jamb or floor.

A Secure Locking Means.—When staples are used in connection with the ordinary hasp method of locking, the door may be opened by anyone who is sufficiently intelligent to use a claw hammer or pry bar to pull the staple out of the wood. A much more secure method is outlined at Fig. 29, C, in which U-bolts are used having a long leg and a short leg. The long leg is threaded while the short leg is not. The long leg is passed through a hole which goes entirely

through the board in the door and at the side of it, while the short one goes only part way into the wood. If desired the short leg may be pointed so that as the nut is tightened against the washer, the pointed prong will be drawn firmly into the wood. In appearance the U-bolts look just like the staples, but as will be evident they cannot be pulled out without destroying the piece to which they are attached.

Furnace Door Opener.—The handy man who has to shovel his own coal in the furnace often finds it uncomfortable to open the hot door by hand, and when approaching the furnace with a shovel full of coal it is necessary to rest the load on the floor with the danger of spilling part of the coal while the door is opened or keeping the door open during the stoking operation, which results in a material loss of heat due to cooling the fire. A very simple arrangement composed of a piece of wire rope passing over the pulley screwed into one of the ceiling joists, one end of which is attached to a hinged board as indicated at Fig. 30, A, provides a method of opening the door by foot power. The wire rope should have sufficient slack in it so that the fire box door can be swung open to its full opening. The pulley screwed into the ceiling is placed a little in front of the door instead of directly over it. Any form of hinge may be used to attach the pedal board to the floor.

Furnace Door Stop.—When valves or other fittings are carried on a pipe that runs close to the furnace, which may be hit by a swinging furnace door, it is possible to damage these by the door bumping against them if it is not carefully opened. A simple method of preventing this trouble and also one that keeps the door from swinging too far is to use a triangular piece made of band iron which swings from the hinge

rod of the furnace door. The method of application is clearly shown at Fig. 30, B.

Automatic Draft Opening Means.—A number of devices have been made, some operating on electrical principles, and others on mechanical systems that will permit opening the furnace draft door any given time. The arrangement shown at Fig. 30, C, outlines a combination of levers, pulleys and weights and may be set in motion by an ordinary alarm clock so that the furnace draft door may be opened automatically by the clock. The door is raised by a cord or a chain which may be operated by two methods. One is a leverage mechanism, the other is a cord which passes through the floor and into one of the upper rooms. The automatic operating mechanism is very simple though it looks complicated. A trip lever is held from the ceiling joists by a simple "A" frame made of wood and is held in a vertical position when the door is closed by a latch member. The end of the latch member is provided with a simple trigger of bent iron, while the long end of the trip lever is attached to a spool which is fastened to the winding key which is employed to wind the clock alarm spring by the medium of a cord fastened over a pulley.

As is well known, when the alarm goes off, the winding key turns around. The spool is attached to the key by sawing a slit across the top of the spool and then gluing it to the key. The alarm is set to go off at the desired time one wishes to have the draft open and when the spool turns it acts as a windlass and winds the cord on it that is attached to the trip lever which pulls the long end up and allows the short end to which the trigger is fastened to drop down. This releases the vertical lever and allows the weight to drop down and raise the furnace draft door by means of a cord or chain attached to

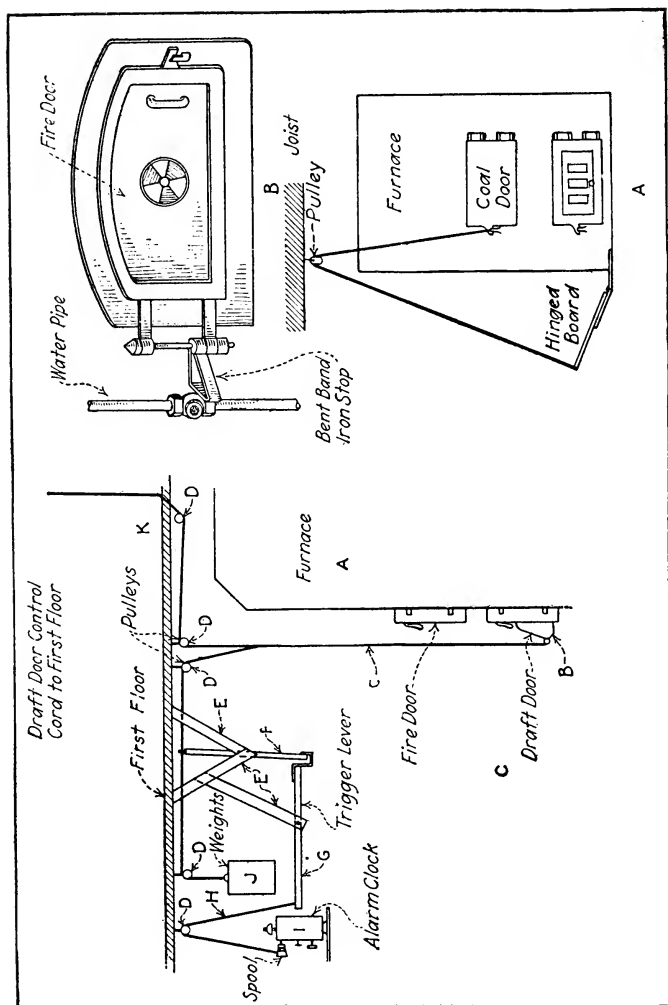


Fig. 30.—Suggestions to Make Furnace Operation Easier.

this member and which passes over suitable pulleys so that the downward motion of the falling weight is changed to a vertical or upward motion of the draft door which opens it.

Simple Broom Hanger.—A piece of brass or iron wire or rod $\frac{3}{16}$ " or $\frac{1}{4}$ " in diameter bent to the form shown at Fig. 31, A, and attached to the wall with a couple of screweyes forms a very good holder for a broom handle. A short bend is made on one end of the straight part so that the hook will be held out from the wall far enough to make it an easy matter to place the broom handle in the hook. The weight of the broom keeps it in position.

Skirt or Pants Hanger.—An economical hanger for skirts and trousers may be made as indicated at Fig. 31, B. In this, two ordinary metal spring clamp clothes-pins are attached to each end of a looped galvanized iron wire $\frac{1}{8}$ " in diameter. The clothes-pins are fastened one at each end of the wire and about 8" apart. As the attaching method consists of fastening the wire through the hinge of the spring clamp, no difficulty is experienced in sliding the clothes-pins to adapt these to hold pieces of varying widths.

Easily Made Door Spring.—An effective and simple spring for screen doors or storm doors may be bent up by the home mechanic from spring steel wire about $\frac{1}{8}$ " in diameter. In order to turn the eye and make a neat job, the wire should be heated, and while red hot should be bent around a piece of wood such as a broom handle or an iron pipe. After the bend is made the spring may be hardened by heating to a red heat and quenching it in oil. The upturned ends of the spring are attached to the door and the door frame by substantial staples. Two of these springs will be suitable for any kind of light door, one placed

near the top and the other near the bottom. For a heavier door it may be necessary to use 3 to 6 springs.

An Economical Door Stop.—A simple door stop that will not mar the door or the floor may be bent up from a piece of steel or brass wire as shown at

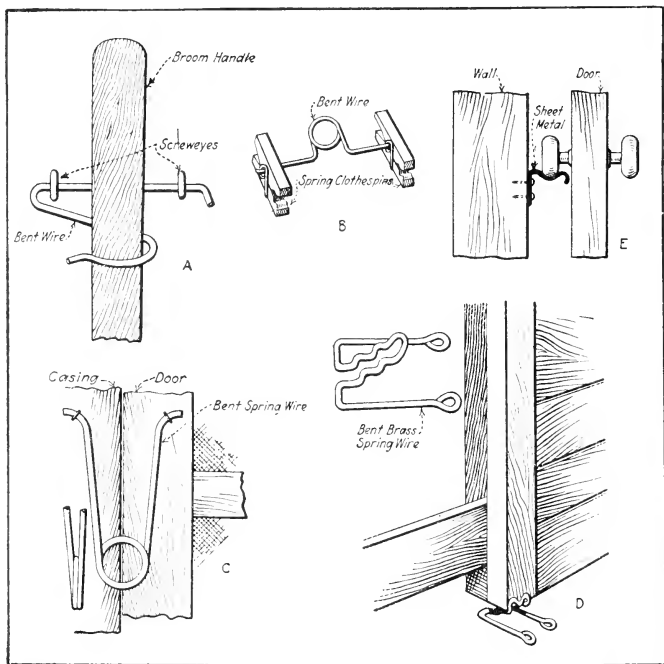


Fig. 31.—Simple Bent Wire Devices for the Home.

Fig. 31, D. This is bent up as shown in the illustration, which also clearly outlines this use. The upwardly bent hook is provided with a step which goes under the door and the back of which acts as a stop to keep it from sliding too far under the door. As there is considerable spring to the bent wire hook it is merely necessary to push the device in place with the

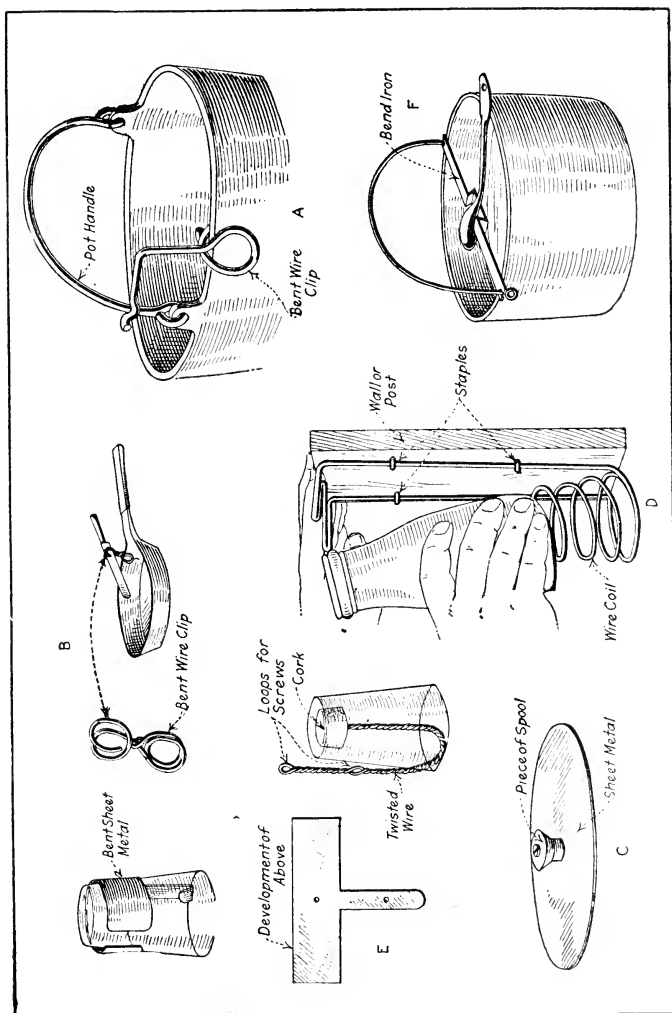


Fig. 32.—Suggestions for Appliances in Wire and Sheet Metal to Help the Housewife.

foot to lock the door open in any desired portion of its swing.

An effective door stop can be made of a piece of sheet metal such as spring brass which is bent up as shown at Fig. 31, E, and which will keep the door from swinging against the wall and the door knobs marring the plaster. The bent end is formed so that the door knob will ride over it and fit into the groove provided for its reception. It is attached to the wall by wood screws as is clearly indicated.

Useful Kitchen Appliances.—Some useful appliances that may be made by the handy man to assist the housewife in the kitchen work are shown at Fig. 32. There is nothing so annoying in cooking as to have to grasp a hot kettle handle which has become heated from resting against the side of the kettle. If the handle is supported in a vertical position, it is evident that it will be kept cool enough so that it will be grasped without discomfort. A simple appliance made of spring wire bent up with a hook at one end to hold up the handle and a clip at the other end by which it may be attached to the side of the kettle will do its work in an effective manner.

Another simple wire fitting that may be easily bent up and that will be found very useful is in a form of the double clip such as shown at Fig. 32, B. This clip can be made of brass wire and will hold a knife to a frying pan so that it is not necessary to place the utensil on a table or stove when frying anything in the pan that needs frequent turning over.

Easily Made Pan Cover.—It often happens that the knobs attached to pot covers become lost or that covers must be extemporized in an emergency to replace one that has become damaged or misplaced. A scheme outlined at Fig. 32, C, shows how an ordinary

spool may be used as a handle by cutting it in half and fastening it in place by a small bolt and nut or by using a rivet of the proper size. An emergency cover that will fit a variety of sizes of kettles can be made in this manner by taking a pie pan and attaching a spool in the center to act as a handle.

Holder for Milk Bottles.—A bent wire holder for milk bottles such as shown at Fig. 32, D, may be made and attached to the sides of the door by means of staples and will prove very useful in keeping the milk bottle off of the stairs or porch where it may be knocked over by cats or dogs, or taken by irresponsible children. The wire is bent so that one end of it forms a spring that is used to provide a support for the milk bottle bottom and hold it firmly in place in the pair of looped arms at the top which encircle the neck of the bottle. Such a holder will be of benefit to both the delivery man and the housewife in that it will save stooping, as it can be attached sufficiently high on the wall or door frame so it can be reached easily without bending.

Drinking Glass Holders.—Two forms of drinking glass holders which may be easily made by the handy man are shown at Fig. 32, E. One of these is made by twisting wire so a loop is provided at two points in which screws may be inserted by which it is attached to the wall, while a large cork on the upturned hook end is a good support for the glass. The other holder is bent up of sheet metal and is also attached to the wall by wood screws. As the fitting is shown both in the development or pattern form and its appearance as bent up, no difficulty should be experienced in making it. A piece of sheet brass is the best material for constructing this holder, as it may be kept brightly polished and cleaned while tinned iron would be apt to rust.

Keeping Spoon Out of Kettle.—A spoon rest for kettles shown at Fig. 32, F, is usually made by taking a strip of light sheet metal or band iron, cutting a notch at one end that will spring into the kettle handle and having a depression in the center to hold the bowl of the spoon. In cooking certain materials where frequent stirring is necessary the support indicated is valuable because the spoon is kept in an accessible position and any material in the bowl will drain back into the kettle.

Home Water Works.—In some cities the drinking water is apt to contain a variety of substances in solution that make it necessary to filter it when it is used for drinking and yet it is good enough so it may be used in its original condition for washing purposes. By using pipe fittings, the home mechanic may easily make a filter that will be cheap and effective. This is shown at Fig. 33, A. A "T" is placed in the main line just back of the faucet and this holds a reducing coupling which supports a piece of $1\frac{1}{2}$ " or 2" pipe about 6" to 8" long. Another reducing coupling of the proper size is placed on the upper end to which a small faucet is attached by means of a couple of nipples and an elbow. Felt or filter paper backed with wire gauze is used at both top and bottom of the pipe to hold the filtering material, which is charcoal, in place. When drinking-water is required it may be drawn through the small faucet and filtered whereas water for other purposes where cleanliness and absolute purity is not essential, may be drawn directly from the mains. This is a big advantage over the usual form of small household filter in which all water used, regardless of the purpose for which it is intended, must pass through a small filter fitting that contains but little screening material.

Garden Hose Repair.—Whenever a leaky spot

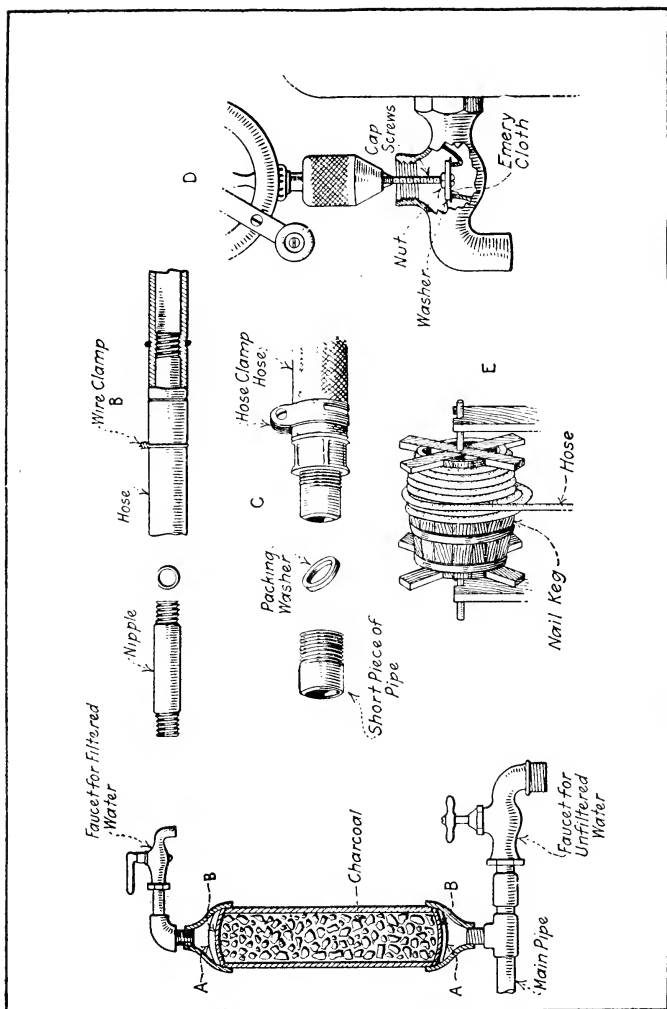


Fig. 33.—The Home Mechanic Can Easily Make the Effective Water Filter Shown at A, and Can Also Make Use of the Other Suggestions.

occurs in the garden hose it is possible to make a good emergency repair that may be kept as a permanent one if desired, as shown at Fig. 33, B. A $\frac{1}{2}$ " pipe nipple about 4" or 5" long with threads turned on the ends, is inserted to couple the two ends of the hose together after the defective portion has been cut out. The nipple is held securely in place by twisting several pieces of hay wire tightly around the hose over the threaded portion which causes the rubber to jam in between the threads and make a tight joint. Ordinary hose clamps may be used for this purpose and will be found considerably more effective than the simple wire, for if these are used it is not necessary to have a threaded nipple, but any short piece of pipe will answer for the coupling that will withstand high water pressure.

Keeping Hose Packing Washers in Place.—In taking a hose off the bib cock or when removing a nozzle from the end of the hose it is not unusual to lose the rubber or leather packing washer that makes a tight joint at the coupling. The kink shown at Fig. 33, C, which consists of putting a short piece of pipe in the coupling to hold the washer in place is one that will save considerable annoyance when the hose is used again.

Repairing Leaky Faucet.—The ordinary faucet will often leak even after new washers have been inserted on the valve. This is because particles of sand or grit have roughened the valve seat and the washer will not fit correctly on the irregular surfaces. A method of refacing the valve seat that is very effective and that can be easily done by the home mechanic is shown at Fig. 33, D. In this, a suitable screw, such as a stove bolt $2\frac{1}{2}$ " or 3" long and a couple of iron washers of the proper size to fit the spigot seat, are used in the manner indicated. A piece of emery

cloth is cut larger in diameter than the valve seat. A hole is punched in the center through which a screw is passed. If the small washer that is placed under the screw head is sufficiently small in diameter to fit inside of the valve seat when used, the emery cloth will be clamped more tightly against the larger washer. The nut of the stove bolt is then screwed down firmly against the top of the large washer to bring the various parts of the assembly tightly together.

By grasping the end of the bolt in the chuck of the hand drill, it will be possible to grind down the face of the valve seat without much trouble. Needless to say, the water supply must be turned off before the valve and its packing nut are removed from the opposite body. The drill press should be held firmly, and if the abrasive paper is turned at a moderate speed the valve seat will be ground smooth. If the valve seat is grooved badly it will be well to start the operation by using the coarse emery cloth, then finishing with finer abrasive.

Home Made Hose Reel.—One of the common causes of garden hose depreciation is because the hose is carelessly stored away, usually in a hopeless mass of kinked and twisted convolutions. When a hose reel is not available the home worker may extemporize one easily by using a nail keg and cross arms made of $\frac{7}{8}$ " x 2" boards. An iron rod, wooden broom handle, or an iron pipe may be used as an axle and is passed through the center of the cross arms and head to act as a bearing. The hose may be easily and quickly coiled over this keg to keep it from being damaged and also to have turns of sufficiently large curvature so the inner walls of the hose will not be injured by bending at too sharp angles.

Useful Hand Trucks.—For handling trunks, heavy boxes, ash cans and other objects of that nature, a hand truck is a very useful thing to have around the house. There is not sufficient use in the ordinary household for a device of this character to warrant the purchase of a warehouse truck, but it is not difficult to make a very satisfactory hand truck from

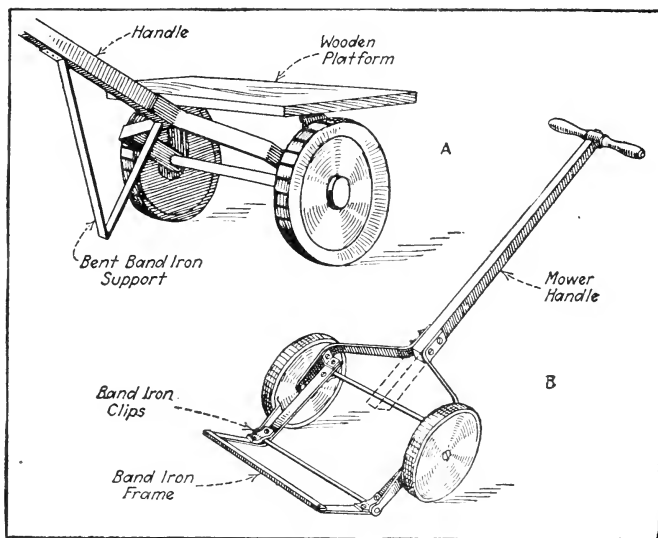


Fig. 34.—How to Convert Worn Out Lawn Mowers to Satisfactory Trucks for Handling Boxes and Barrels.

a discarded lawn mower. The form shown at A, Fig. 34, outlines practically all of the mower parts except the knife-blades and the roller. After the rotary cutting-knives are removed and the knife-blade is taken off the outer bar, the mower is turned over and a piece of board is attached to the cutter bar, which forms a substantial platform. A piece of band iron is then bent to form a supporting leg that is

attached to the lawn mower handle by bolts as indicated.

In the form shown at B, the roller and cutting-knives are removed as is the gearing from the interior of the wheels. The latter may then revolve on their axle without having any connection with the cutter shaft. An iron framework is bent up from bar iron of suitable size and is held in place by easily made clamps and angle pieces which are also bent from strip band iron and securely attached to the iron frame by suitable bolts. The arms that formerly supported the roller are now used to hold the brace rod that acts as a support for the lower portion of the bent iron frame. The construction is such that the truck may be as easily placed under a barrel or crate as the usual form of warehouse truck is. The truck may be made considerably stronger by extending the lawn mower handle as indicated by the dotted lines so that it may be attached to the rear brace rod by suitable clamps.

Package Carrier for Bicycles.—A simple and easily made accessory that will increase the usefulness of a bicycle can be readily contrived by the home mechanic out of odds and ends that will perform the work just as well as any luggage carrier purchased from the usual sources. The manner in which an old bicycle fork, which can be secured from an old bicycle frame or from any junk shop, may be employed as a substantial support for the carrier board is shown at Fig. 35. All that is necessary to use the fork as a support is to cut off the tube that projects into the steering head so that it will only be about $1\frac{1}{8}$ " long. The hole in the fork end may have to be drilled out as the usual size bicycle front axle is $\frac{5}{16}$ ", while the axle of the rear hub is generally $\frac{3}{8}$ " in diameter. The carrier is made of any piece of $\frac{7}{8}$ "

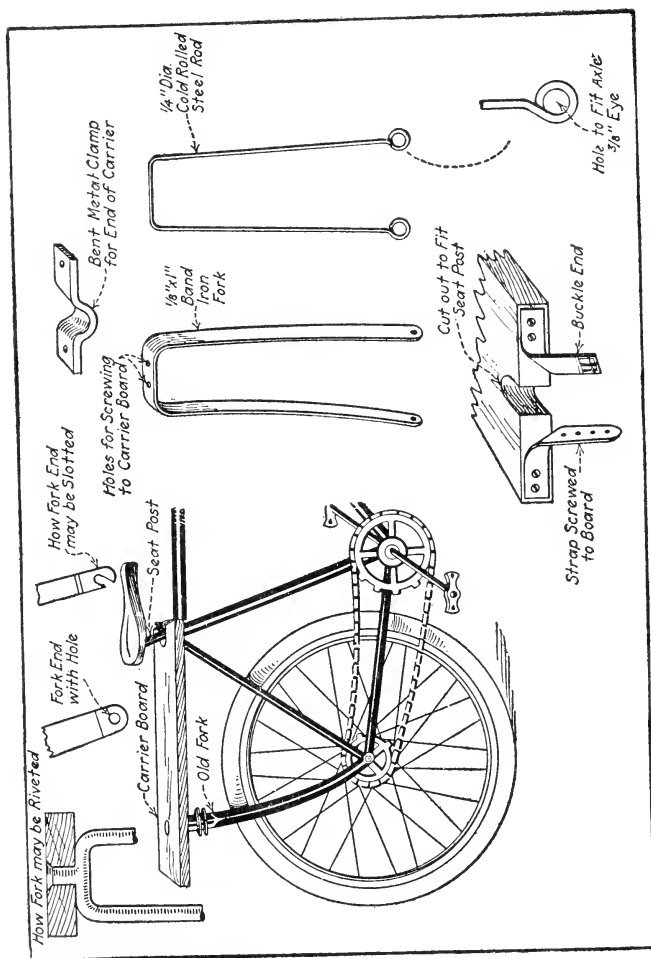


Fig. 35.—Easily Made and Inexpensive Parcel Carriers for Use on Bicycle.

stock that happens to be available, and a hole is bored in this to permit the tube above the fork crown to enter into it, and as this has been cut $1\frac{1}{8}$ " long it should project $\frac{1}{4}$ " above the face of the board. The top edges of the hole are chamfered and the tube projecting through it is peened over so that the board is securely held against the fork crown.

A notch is cut in the front end of the board to fit around the seat post and the board may be held in place by either a leather or a metal strap. To fit the device to the bicycle, the nuts are removed from the ends of the rear wheel axle and the fork ends are sprung over the projecting axle, or, if the fork has slotted ends, as are sometimes found on front forks, these may be pushed right in place after the locking nuts are backed off without spreading the fork as much as will be necessary if holes and not slots are used. It may simplify matters and make installation easier if the fork ends are slotted by cutting out the metal at one side of the hole with a hacksaw.

If an old bicycle fork is not available it is easy to make a brace that will support the board by either of the schemes shown at B, Fig. 35. In one case, the support may be made by bending up an $\frac{1}{8}$ " x 1" band iron and drilling holes at the top so it may be fastened to the carrier board by screws or bolts and providing drilled or slotted ends to fit the rear hub axle. The other system is to take a piece of $\frac{1}{4}$ " or $5/16$ " diameter cold rolled rod, bend up the eye at each end and then bend it in the form of an elongated "U" member that may be attached to the carrier board by staples. In order not to take up too much room on the hub axle, the eyes should be flattened so they are no more than $\frac{1}{8}$ " thick. A number of modifications of the carrier shown may be carried out to suit the pleasure of the person making it. A light metal

rack may be made by bending up band iron strips and riveting them together to form a basket, or by attaching a woven wire basket to the board that may be obtained from a hardware store and which is sold for parcel carrying purposes.

Picture Frame Hanging Made Easy.—It is surprising what a number of useful appliances, that will greatly simplify the work about the home, may be made by the use of odds and ends of materials and the exercise of a little ingenuity. The picture frame hanger shown at Fig. 36, A, is a good example of how a very simple fixture will make a hard job easy. The first step is to form a holder for the hook that fits over the moulding which is made of spring brass or strip steel by using the hook as a guiding pattern. This is attached to the top of the pole, which is notched out to receive it, by a wood screw. The picture cord is passed over the hook, which is then inserted in the holder as shown in the illustration and the hook may be easily placed over the moulding without standing on a chair or stretching to reach the moulding. After the picture is in place it is not difficult to remove the holder from the hook by simply rocking it off by working the bottom of the pole.

Metal Corners From Tubing.—The home mechanic who wishes to put metal corners on a tool box or chest of any kind finds it a considerable job to bend up a piece of sheet metal to form a reinforcement that will have a good sharp bend. A very easy way of obtaining clean cut metal corners is to secure square section metal tube of the proper size, such as is used in making bedsteads, and cutting off the metal at the opposite corners with a file as shown at Fig. 36, B. When corners at opposite sides are cut off, two angle pieces are left that will form a very satisfactory reinforcement, after holes are drilled or punched

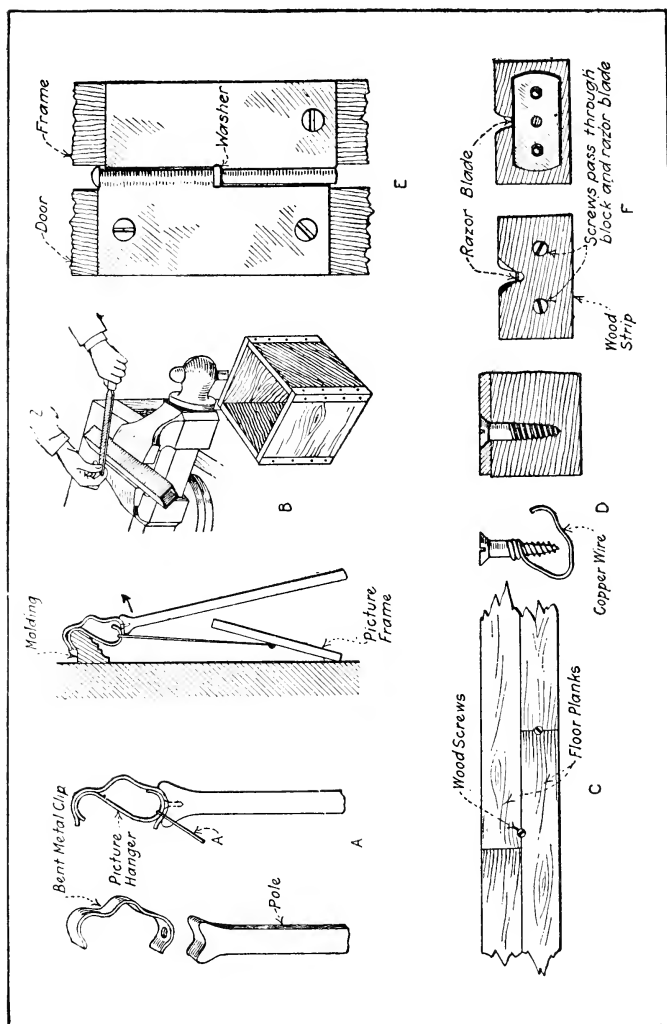


Fig. 36.—A Variety of Useful Suggestions to Help the Home Mechanic in His Work.

through to receive the nails or screws by which they are to be fastened to the box corner.

Fasten Floor Boards.—A simple expedient shown at Fig. 36, C, is a good preventive of squeaking floor boards. The reason these are noisy when stepped upon is that fastenings have loosened due to seasoning or drying out of the wood, which allows the sides of the boards or their edges to rub together. This may be prevented by screwing wood screws of the flat head form in between the cracks, which will either spread the ends apart slightly so that they will not rub, or, which will hold the boards securely in place.

Making Wood Screws Tight.—When door hinges or other pieces that cannot be easily changed in position become loose due to the movement of wood screws holding them, these having become loosened in the holes, there are several methods of remedying the condition. One of them is to drive a wood plug in the enlarged holes and then replacing the screws. Another way is to use a larger screw, which usually calls for drilling out the holes in the hinge so the enlarged shank will pass through. The method outlined at Fig. 36, D, which has proven to be successful in some applications consists of winding the defective diameter of the threaded part and really makes an enlarged screw that will be of better fit in the hole.

Raising a Sagging Door.—An easily applied remedy for raising a door that has sagged so that its outer ends rub on the floor, and that does not call for resetting the hinges, is shown at Fig. 36, E. In this, the halves of the hinges are spread apart enough to lift the door by placing two washers between the two portions of the hinge, so that the door is raised slightly. A $\frac{1}{8}$ " washer will often raise the door enough so that the end will not rub on the floor. A washer should be used in both upper and lower hinges.

If the door is supported by three hinges, it will not be necessary to use washers in the middle hinge.

Efficient Cord Cutter.—A blade that has done its duty in a safety razor may be used still further by fitting it to a block of wood as shown at Fig. 36, F, which will form a very good string or cord cutter when it is screwed to the end of a counter or a table. A notch is cut in the wood piece so that a portion of the blade sticks up enough to cut the string when it is pressed down into the notch. The blade is held in place by screws which pass through the wooden piece and when the blade becomes dull it may be readily removed for sharpening or for inserting a new blade in the holder. The method of construction is so clearly shown that any home mechanic can easily make this useful device.

Locating Drain Pan.—One of the annoying household tasks is emptying a drain pan from under the bottom of the icebox and replacing it after it is emptied so that it will be located properly in regard to the icebox drip pipe. The kink shown at Fig. 37, A, is a simple method of insuring the location of the waste water receptacle without stooping over and looking under to make sure that it is properly placed under the waste opening. Two cleats or wood pieces are attached to the floor in a "V" shape under the icebox with the apex of the "V" so located that the pan will be in the center under the drip pipe if both sides of it are in contact with the guiding strips.

Preventing Splash of Waste Water.—Another method of insuring that the drainage from the icebox will fall into the pan and not on the floor is outlined at Fig. 37, B. In this, the water container is carried in the basement and the waste water is directed through the floor under the refrigerator by a funnel. In some cases, there is no connection between the

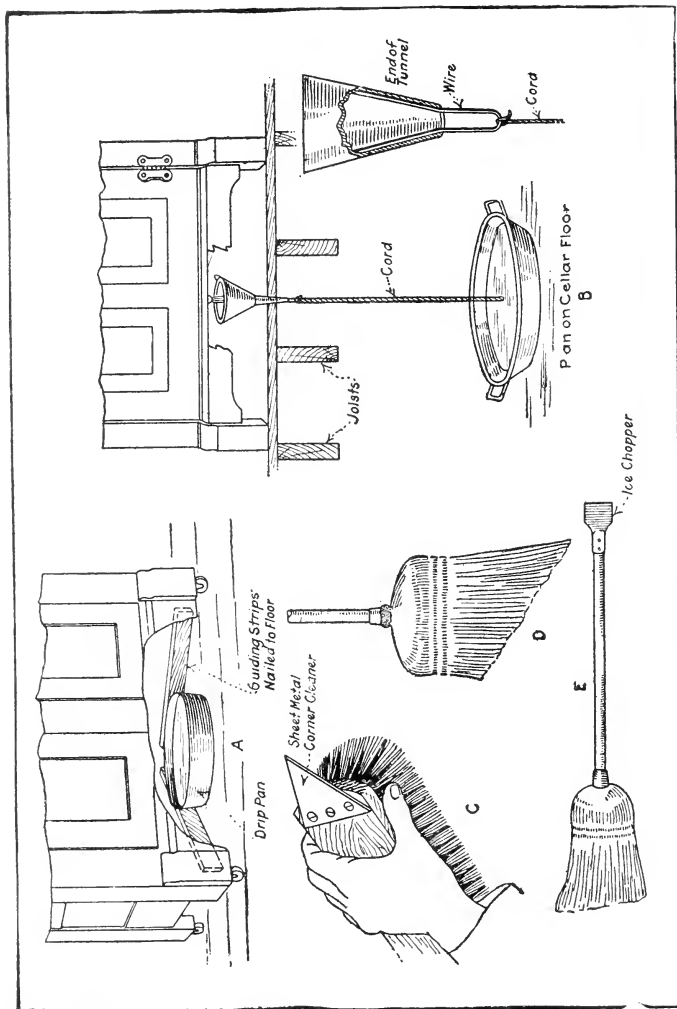


Fig. 37.—Method of Handling the Ice Box Drippings are Shown at A and B. Brush and Broom Improvement Outlined at C, D and E.

bottom of the funnel and the pan and the water must drop 8 or 10 feet. If the pan is set on the floor, the water will splash around and cause an annoying wetted area around the pan that must be mopped up constantly. There are two methods of making sure that the water will reach the pan without splashing. An obvious one is to connect the bottom of the funnel with the waste water pan by means of a piece of rubber hose. The method shown is a cheap and effective one. A piece of wire is bent to fit the side of the funnel spout and a piece of string attached to it leads down to the pan. The water will drip down by following the string and will not splash because of its gradual movement. When the string becomes dirty it may be easily removed.

Cleaning Dirt Out of Corners.—It is hard to reach the corners of a room with an ordinary form of floor brush when scrubbing floors and dirt will collect there and become so hard that it cannot be washed out. The handy man may put a simple attachment on the end of the floor brush handle that will make it possible to thoroughly clean out the corners without having to get up and get an old kitchen knife to do the work. The pointed piece of metal is attached to the handle by wood screws as shown at Fig. 37, C.

Another expedient when sweeping out corners is to take a worn broom that is no longer useful for ordinary sweeping and to cut the straws off diagonally as shown at Fig. 37, D, so that the pointed end will go into the smallest corner and remove the dirt collected there. A broom of this kind is especially useful in sweeping boxed-in stairs where there are numerous corners.

Combined Broom and Ice Pick.—The home mechanic will find that if he adds an ice chipper to a large broom handle as shown at Fig. 37, E, that he has a

very satisfactory appliance for removing a light fall of snow from the sidewalks and when he encounters a piece of ice, it may be easily chipped by reversing the position of the broom and then the loosened particles may be swept off by using the other end. Combining the two appliances that must be used together in this way saves space, time and makes it easier to do the work.

Sleeve Pressing Board.—The handy man who wishes to exercise his wood-working talents can not only increase his knowledge of wood-working but also make a number of devices and household appliances that have real merit. As an example of what may be done, the sleeve pressing board at Fig. 38, A, may be constructed. It is composed of a piece of board about 30" long, 8" wide and $\frac{7}{8}$ " thick, to which two standards or short upright pieces are nailed to support the sleeve board, which is cut out of a piece of $\frac{7}{8}$ " stock of the desired shape and size. The sleeve board may be hinged to one of the supporting pieces by using screw-eyes, which are screwed into the bottom of the board and, which are guided by screws let into the sides of the standard that supports the big end of the board. It is also possible to use an ordinary form of hinge for this purpose, but if a removable hinge is provided, the boards may be readily taken down if desired.

Ironing Board Support.—The ironing board support as shown at Fig. 38, B, is also a useful appliance, as it enables one to swing the ordinary form of ironing board from the edge of a kitchen table and thus secure more supporting surface when ironing large pieces. This support is made of a piece of $1\frac{1}{2}$ " thick board provided with two notches at one end as shown. It is made of proper length, which can best be determined by experiment so the ironing board will be

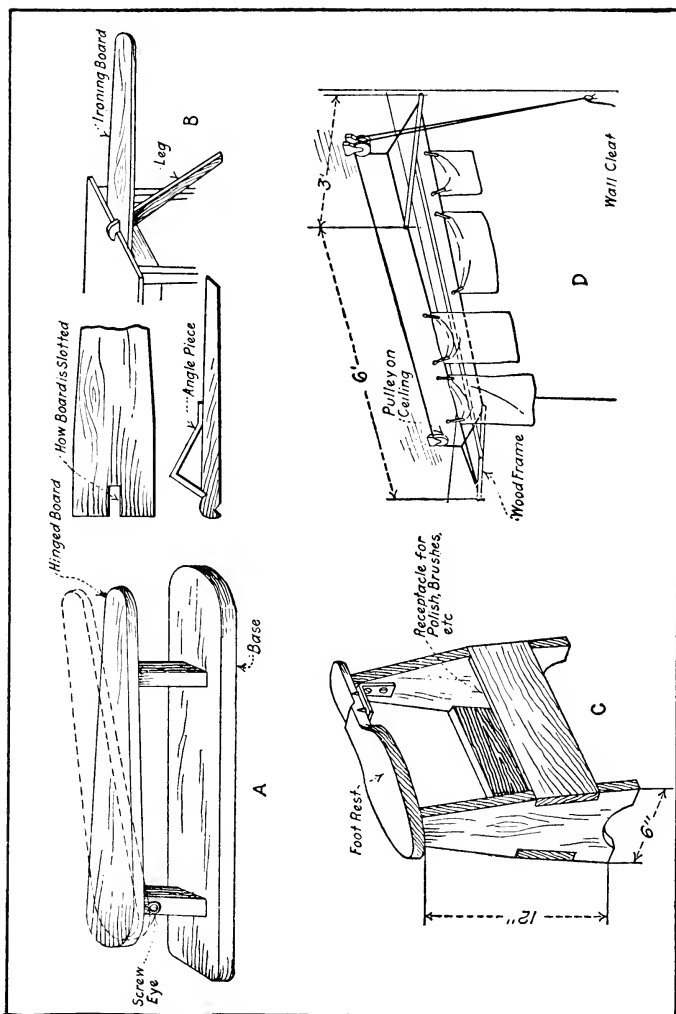


Fig. 38.—Miscellaneous Useful Household Appliances That May Be Made by the Home Mechanic Who Understands Wood-working.

held firmly against the projecting table top. A slot is cut into the big end of the ironing board, which has been squared off, wide enough to receive the supporting leg and about 4" long. This admits the one supporting member to the notch, clamping down one notch cut in it on the table, and the other notch holding the ironing board up as indicated. In order to provide more supporting area for the board, a piece of wood of triangular form may be attached to the leg as an added support or a piece of band iron bent to the form shown, may be secured to the support. It will be found that a supporting leg of this kind will give a very good support to the ironing board and as that member is held at only one end, it can be used to special advantage in ironing skirts and dresses, which can be pushed over the open end easily.

Simple Shoe Polishing Stand.—A shoe polishing stand that will assist materially in keeping the shoes of the members of the household properly cleaned may be made by following the suggestions and illustrations at Fig. 38, C. The ends may be made of $\frac{7}{8}$ " stock and approximately to the dimensions indicated. The side pieces may be made of lighter stock and the bottom board, which is nailed across the two end pieces and attached to the side pieces to form a box, may be made of any desired materials. The box is very useful for holding polishing cloths, brushes and polishes. The top piece, which serves to support the foot, is shaped approximately as the sole of the shoe is, and is made of a block of wood about 3" wide, 9" long and 2" thick. It is attached to the upright standards or end pieces by means of angle pieces securely fastened to the block and end pieces by wood screws, or by long wood screws running through the block from the top extending into the side pieces.

Indoor Clothes Hanger.—An overhead clothes hanger, such as shown at Fig. 38, D, is very useful for handling small washings during wet or cloudy weather. It is especially valuable in a household where there are children. It is easily made and installed, and will be of great convenience to the housewife as it can be kept out of the way by being raised close to the ceiling when not in use. It may be made in the form of a square frame of wood or a substantial centerpiece to which the two end pieces are attached. Lines are stretched from the end pieces to which the clothes are hung. The assembly is raised by simple cord connections, which pass over pulleys fastened to the ceiling. The end of the cord is attached to an anchoring hook or cleat on the wall and the device may be readily lowered for hanging the clothes and then raised out of the way close to the ceiling while the clothes are drying or when the appliance is not in use. The dimensions indicated are only given as a guide and obviously may be varied to suit the requirements of the individual, and the space available for hanging the dryer.

Improving Linen Closets.—A number of ways in which the capacity of closets of various kinds may be increased and the material stored away in them made more accessible are clearly outlined at Fig. 39, and the suggestions given are of such character that it may be easily followed by the home mechanic. The combined drawer and shelf, which is composed of a shallow tray opened at the front as outlined at Fig. 39, A, is much superior to either drawers or shelves of the ordinary form for storing away household linen such as sheets, towels, napkins, tablecloths and other such objects, which may be piled up neatly on the sliding shelf. When a shelf is pulled out it is possible to reach the material at the back end as

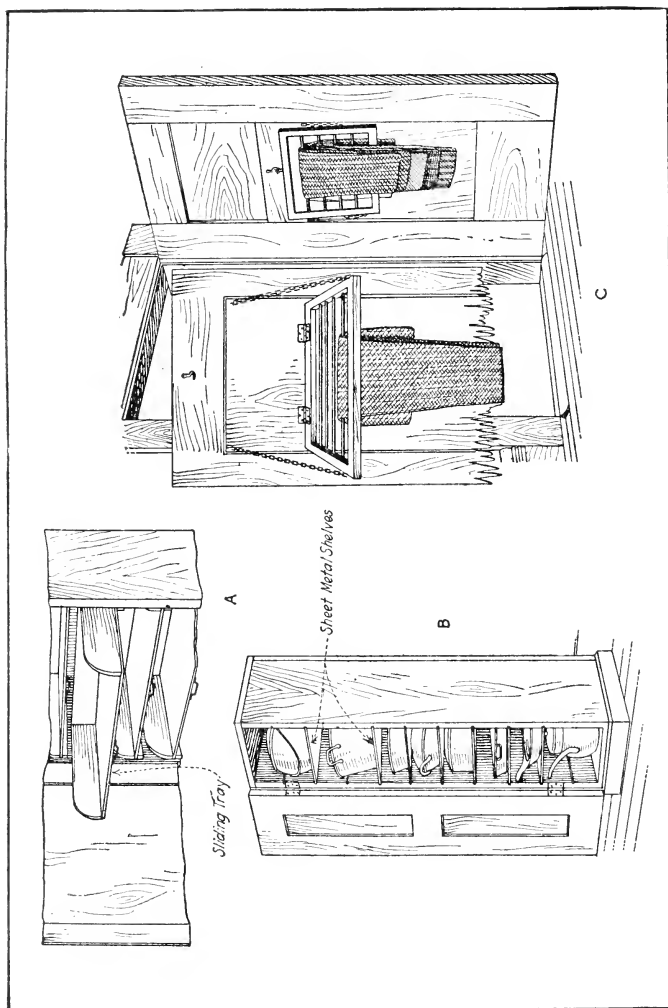


Fig. 39.—Some Improvements That are Possible in Closet Construction.

easily as at the front. The shelves or trays are easily made in the usual manner, being simply shallow boxes without a front board and with the ends rounded. A draw pull is attached to each shelf so that it may be easily pulled out of place. As many holders are provided as is deemed necessary and the door of the closet will keep out the dust.

Storing Kettles and Pans.—The illustration at B outlines a cupboard in which various kitchen utensils may be stored in orderly fashion without occupying an excessive amount of room and at the same time being out of sight and readily accessible. The cupboard is a simply made box of sufficient depth and width to receive the largest of the utensils ordinarily used. It may be made as high as desired, but it is not advised to make it more than 7' high, as any pot or pan may be reached easily if that height is considered the maximum. The sides of the closet are provided with small wooden cleats to form the shelf rest, or the sides may be scored at even intervals, say every 4", with sawcuts about $\frac{3}{8}$ " deep. The shelves may consist of squares of galvanized iron and are held in place by being inserted into the grooves or rested on the cleats. It is recommended that the groove system be followed because the shelves are held securely and may be readily adjusted in different grooves to accommodate utensils of different sizes. The closet may be made of any desired wood, which may be given a finish to match the woodwork of the kitchen. If it is desired to paint the cabinet white, the wood used need not be so good in quality as that necessary if a natural finish is desired. The door may be made in paneled form and is attached to the closet by suitable hinges.

Trouser Hanger for Closet.—An easily made trouser hanger that will provide accommodations for from

four to six pairs without losing the crease, may be easily made by the handy man as illustrated at Fig. 39, C. A wood frame is made, which is hinged to the inner side of the door, having chains to prevent it from dropping too far when it is released. Cross bars made of brass curtain rods, or of steel rods are assembled into the frame as shown, over which the trousers are hung. The frame is lowered to remove the trousers or to place them in position, and after these are in place, the frame is swung up flat against the door and held in position by a small hook and screw-eye arrangement.

Installing Curtain Pole.—The method of hanging a pole or support for curtains or portieres, shown at Fig. 40, A, is a very good one, because no fixtures are needed and the pole is held as securely as though more expensive fastenings were employed. The pole is cut about $\frac{1}{4}$ " shorter than the space between the door casings. A $\frac{3}{8}$ " hole is drilled in each end, one about $\frac{3}{8}$ " deep and the other about $1\frac{3}{4}$ " deep. Ordinary screws, having a $\frac{3}{8}$ " wide flat or button head, are screwed into the door frame to act as bearings for the pole. A coil spring is placed in the deep hole as indicated. To put the pole in place, the end containing the spring is put on the screw, which projects the furthest and the spring is compressed enough so that the pole may be moved up opposite the other supporting screwhead and placed over it. The pressure of the coil spring will keep the pole in place on the screws. If button head screws are used a superior bearing will be obtained as the screwheads will not cut into the pole.

Using Electric Flatiron for Stove.—A method of supporting an electric flatiron so that it may be used for heating water is shown at Fig. 40, B. A piece of sheet metal is cut to the shape indicated and when the

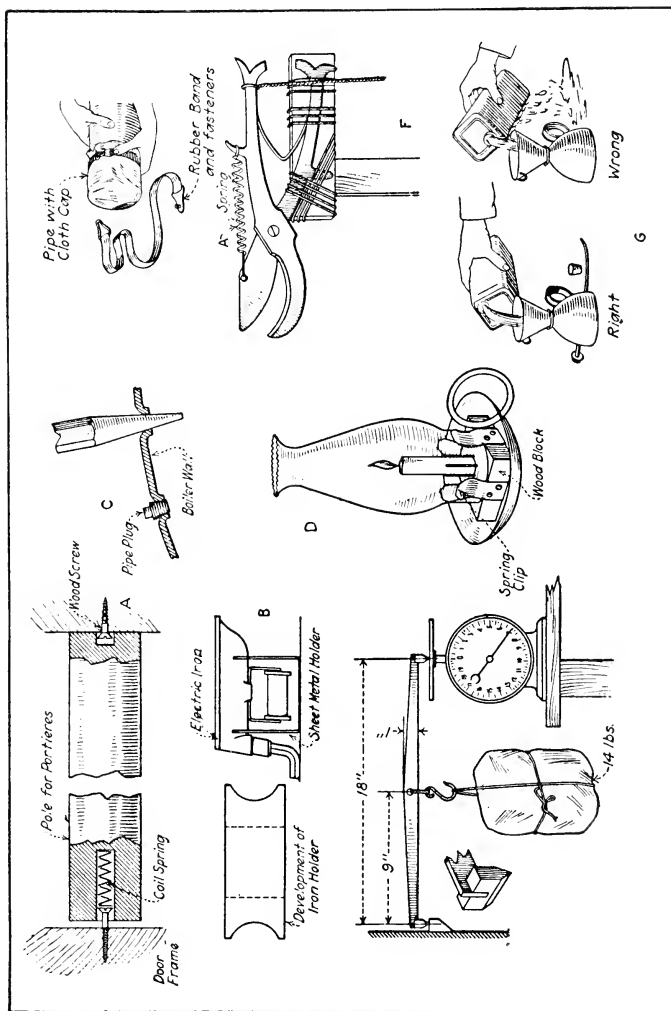


Fig. 40.—Miscellaneous Suggestions for Doing Hard Things in an Easy Way.

legs are bent up it forms an effective support for the electric iron. The frame may be made of wire or any other heat-resisting material. The utility of the ordinary electric flatiron for this work is so well recognized that some makers of these appliances furnish a stand with it so that it can be used as a hot plate or stove when desired.

Range Boiler Repair.—It is a general impression that is fostered by plumbers, that punctured hot water range boilers cannot be repaired and they are justified in their claim to some extent if repairs are attempted by means of solder, which will not always hold against pressure. Of course, if the home mechanic is a capable workman and understands the method of sweating a patch in place on the boiler, a secure repair may be made. The method shown at Fig. 40, C, has been recommended and will make a satisfactory repair in some cases. The tapering end punch is driven into the hole so that the point of a small machine screw or small pipe plug will just enter. A tap is then screwed into the hole to cut the thread and a suitable plug or screw is screwed in after its threads have been smeared with red lead or other pipe joint compound. If solder is run in around the threads and the projecting portion of the screw or plug, an absolutely tight joint will be obtained.

Cheap Candle Lamp.—The candlestick holder shown at Fig. 40, D, is easily made and will prevent the candle from being blown out by the wind, as it is carried from place to place. A block of wood of the same diameter as the lamp chimney forms the base to which spring clips are tacked or screwed to hold the chimney in place. The size of the candle base is marked out on the block by tracing its outline with a lead pencil, and three fine wire nails are driven in the block, spaced equidistant on the circle, indicating the

base of the candle to form a holder for it. Short candles are used and as the flame burns steadily without the flicker that is noticed when the candle is exposed, as in the ordinary candlestick, a good light is obtained. Another advantage is that the candle lamp is much safer than the usual open form, as curtains cannot come in contact with the flame, as it is protected by a chimney. The wood block is set into a metal saucer to which a ring or piece of sheet material is soldered to serve as a finger hold, or it may be used without the pan by attaching it to a larger block.

Keeping Soot in the Stove Pipe.—One of the tasks that is not relished by either the housewife or the home mechanic is removing the stove pipe for cleaning, as the dirt and soot collects in the pipe and falls out all over the clean floor and over the persons manipulating the pipe. A simple cloth cap, as shown at Fig. 40, E, may be held in place over the open end of the pipe by a piece of rubber band provided with any suitable fastening. A paper bag tied on with a piece of twine will answer the purpose and keep the soot in the pipe while it is being carried. In localities where several stoves must be taken down every spring and stored away for the summer, this little hint will be found of value.

Clipping Trees Without a Ladder.—An extension handle for a tree clipper may be easily extemporized for pruning high branches on small trees that are not sufficiently strong to hold a ladder is shown at Fig. 40, F. A crosspiece is nailed to the end of a long handle, and the clippers are securely attached to it by means of heavy cord or wire. The jaws are kept apart by a coil spring which fits into a hole drilled in one of the cutting blades at one end and around the finger rest hook at the other. A wire or cord is attached to the movable clipper handle and forms a

connection by which the operator on the ground may move the clipper jaw to cut off small branches and twigs that are ordinarily removed in pruning and that could not be reached in any other way.

Emptying Square Oil Can.—When turning oil from a square oil can an inexperienced person is apt to spill a considerable amount because the oil gurgles out and runs down the side of the can as indicated at Fig. 40, G. The can should be held so that the opening is at the upper corner instead of the lower one, and the stream of oil coming out of the hole should not be the full size of the orifice, in order to allow air to enter the can and take the place of the displaced oil.

Doubling Capacity of Spring Balance.—Spring scales ordinarily used in the household, whether of the platform type or of the extensible spring form are limited in capacity, and when it is desired to weigh the contents of a package that weighs more than the capacity of the scale, the usual method is to weigh the contents of the package in sections if the material is of such form that it may be divided into smaller packages. It is sometimes necessary to weigh a large package that cannot be divided, so the suggestion given at Fig. 40, H, may be followed. In this, a simple beam or lever is used and the package to be weighed is suspended from its center. One end of the beam may be hung from any suitable support, which should be on a line with the top of the scale, while the other end is attached to the scale hook or pan, resting on the center of the latter, depending on the type of spring balance employed. In this way, packages weighing twice as much as the capacity of the scale may be weighed, as only half the weight of the package will be indicated by the spring balance. While the beam shown is carefully made, any odd stick can be used as a lever. The necessary precautions to

insure accuracy in weighing are, that this rests at but a single point at either end and that the hook for supporting the package be placed directly in the center of the beam.

Simple Magazine Rack.—The handy man or boy, who would like to try his hand at simple joiner work or cabinet making, can spend several evenings profitably in making the magazine stand shown at Fig. 41. The material recommended is quarter sawed white oak, though it may be made of other wood, such as maple or birch, and stained or painted any suitable finish. When white oak is used, the wood may be fumed, because it contains tannic acid, while a smooth surface wood, such as birch, takes a mahogany stain well, or an enamel. Even such an ordinary wood as white or yellow pine may be used if the stand is to be painted. The stock may be ordered from the mill cut to sizes as given in the following bill of material, or the workman may get the pieces out himself from whatever odds and ends of lumber he has available.

BILL OF MATERIALS

<i>Name of Part</i>	<i>No. Required</i>	<i>Size</i>
Legs or Corner Posts	4	1½" x 1½" x 48"
Shelves	4	7⁄8" x 15½" x 16½"
Vertical Side Pieces	2	7⁄8" x 3" x 35"
Horizontal Side Pieces	2	7⁄8" x 6" x 15"
Horizontal Side Pieces	2	7⁄8" x 4" x 15"

In building the rack, the first thing to do is to assemble the sides. Cut the tenons on the top and bottom horizontal side pieces, and also on the vertical side strips. The mortises are cut exactly in the center of the side pieces to receive the tenons on the vertical pieces. The corner posts are then mortised out to receive the tenons on the ends of the horizontal

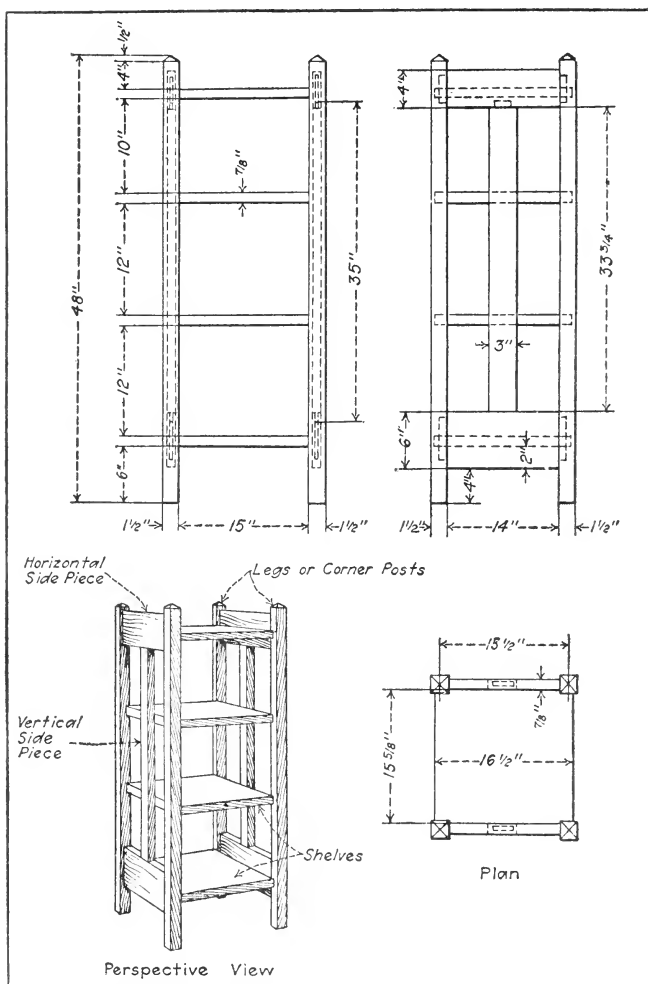


Fig. 41.—Working Drawings for Making Magazine Rack in the Home Workshop.

side pieces. These pieces are glued and held together by clamps for at least 24 hours. The shelves may be cut of one wide board or built up as conditions demand. The corners should be cut accurately so they will fit the legs. There is a variety of ways of securing the shelves to the corner posts. They may be held

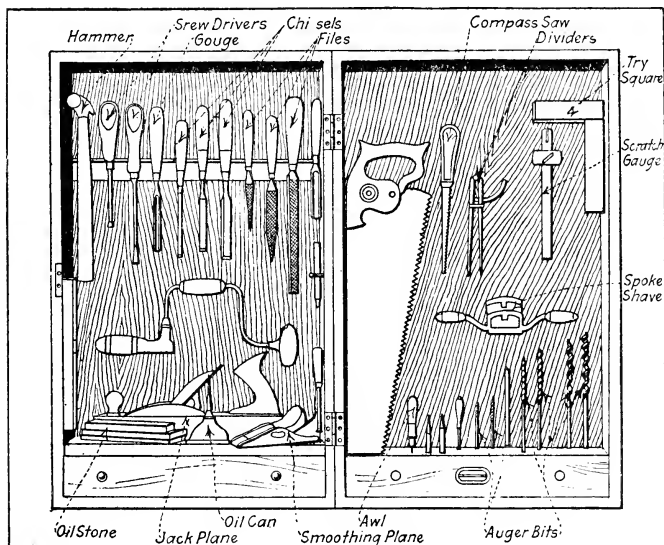


Fig. 42.—A Tool Cabinet for the Home Workshop.

by flush head wood screws, by small lags or by nails. The sides and shelves should be scraped and smoothed with sand paper before assembling, as the work is more easily done when the parts are separated. In sanding, one should always rub with the grain of the wood to avoid scratches.

Fuming is accomplished by standing the finished rack, if of oak, in an air-tight box, and standing several

dishes of strong ammonia around the stand where the fumes will rise. The ammonia will react with the acid in the oak and after ten hours, a deep rich brown shade will result. Any cracks in the box or its cover may be sealed sufficiently tight by pasting strips of paper over them to keep the fumes confined around the rack. After the wood is colored, a furniture wax finish should be applied.

Cabinet for Wood-working Tools.—The cabinet shown at Fig. 42 is not difficult to make and provides an ideal place for storing away wood-working tools when not in use, so these are kept clean, dry and in good condition as regards cutting edges. It may be made of cheap wood and painted, but if the home mechanic wishes to make a real job of it, he can use oak, walnut or mahogany, or combinations of wood to make a cabinet that will be ornamental as well as useful.

The cabinet consists of two shallow boxes, one serving as a cover for the other. The shallowest box serves as a cover or front half and is 32" high by 19" wide by $3\frac{7}{8}$ " thick, outside dimensions. The panel front is made of a frame of $\frac{7}{8}$ " stock to which a $\frac{1}{2}$ " thick panel board, 14" x 26" is attached, being held in place by a suitable rabbet or ledge in the frame pieces. The deeper box is made entirely of $\frac{7}{8}$ " stuff, and is 32" high by 19" wide by $5\frac{7}{8}$ " deep, outside dimensions. If the stock is dressed down to $\frac{3}{4}$ " thickness, the dimensions will vary slightly from those given. A shelf is placed $3\frac{1}{16}$ " above the bottom and a small drawer fills the space between the shelf and bottom of the rear half as shown. The only mortise and tenon joints are in the front panel frame, the top and bottom end frame pieces carrying tenons to fit mortises in the side pieces. All other joints except those of the panel front and drawer, are of the

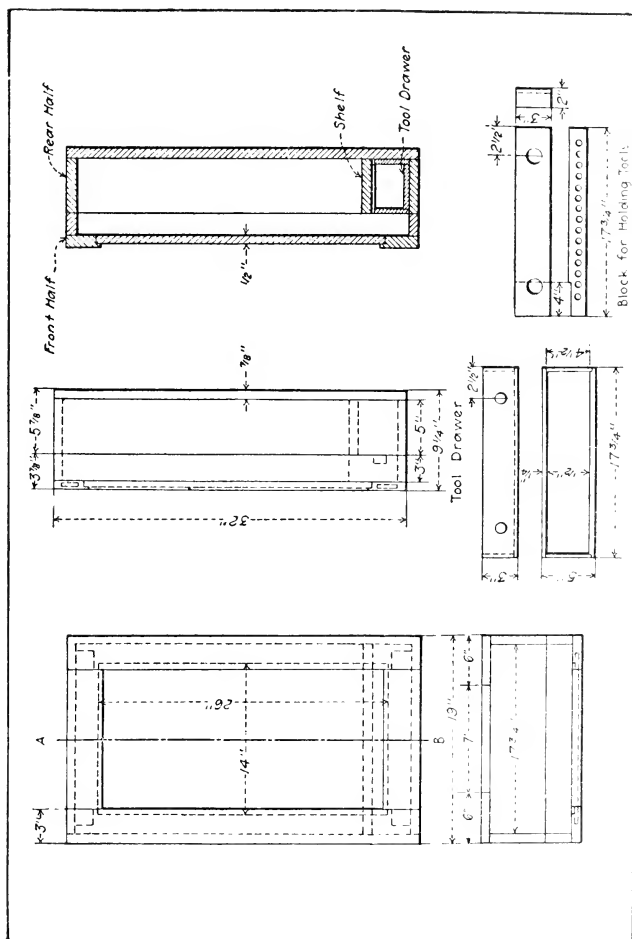


Fig. 43.—Working Drawings for Building a Practical Tool Cabinet.

butt nailed or screwed joint form. The drawer front is made of $\frac{1}{2}$ " stock, the sides, back and bottom is $\frac{1}{4}$ " thick stock. The two halves of the cabinet are held together by hinges so that the front half may be swung open and all the tools the cabinet contains will be easily accessible.

The drawer shown is used for smaller tools such as punches, nail sets, chisels, etc., that are not provided for otherwise. A tool-holding piece is placed at the bottom of the front half of the cabinet. Two holes are cut into the face to receive the drawer pulls, and a series of holes are drilled in the top to receive various bits and other tools. As all dimensions are given, as well as structural details, the home mechanic will have no trouble in following the diagrams and building a practical cabinet that will last a lifetime. The bill of materials appended gives the sizes of the pieces needed to complete the work. The length given for the front frame top and bottom end pieces, allows for cutting the tenons in the ends. The ledge running around the inside of the frame may be cut in with a plow plane or may be made by making a saw cut of the proper depth on the face of the pieces before assembly, and cutting in to meet it with a chisel, gradually cutting out the material.

BILL OF MATERIALS

FRONT HALF OF CABINET

<i>Name of Piece</i>	<i>No. Required</i>	<i>Size</i>
Front Panel Frame Side Piece	2	$\frac{7}{8}$ " x 3" x 32"
Front Panel Frame End Piece	2	$\frac{7}{8}$ " x 3" x 16 $\frac{1}{2}$ "
Front Box Sides	2	$\frac{7}{8}$ " x 3" x 32"
Front Box Ends	2	$\frac{7}{8}$ " x 3" x 17 $\frac{3}{4}$ "
Front Panel	1	$\frac{3}{2}$ " x 14" x 26"
Tool Holding Block	1	2" x 3" x 17 $\frac{3}{4}$ "

REAR HALF OF CABINET

Rear Box Sides	2	$\frac{7}{8}$ " x 5" x 32"
Rear Box Ends	2	$\frac{7}{8}$ " x 5" x $17\frac{3}{4}$ "
Back Board	2	$\frac{7}{8}$ " x 6" x 32"
Back Board	1	$\frac{7}{8}$ " x 7" x 32"
Shelf Board	1	$\frac{7}{8}$ " x 5" x $17\frac{3}{4}$ "
Drawer Front	1	$\frac{1}{2}$ " x 3" x $17\frac{3}{4}$ "
Drawer Back	1	$\frac{1}{4}$ " x $2\frac{3}{4}$ " x $17\frac{3}{4}$ "
Drawer Ends	2	$\frac{1}{4}$ " x $2\frac{3}{4}$ " x $4\frac{1}{2}$ "
Drawer Bottom	1	$\frac{1}{4}$ " x 5" x $17\frac{3}{4}$ "

CHAPTER IV

HOW TO DO THINGS ELECTRICAL

Electric Bell and Annunciator Wiring—Push Button Construction—Electric Wires and Wiring—Simple Batteries—Dry Cells—Wiring Dry Cells—Electric Bell Construction—Simple Bell Circuits—Conventional Domestic Installation—Joining Wires—Overflow Alarm—Simple Annunciator—Electric Alarm Clock—Simple Fire Alarms—Simple Terminals—Magnetizing Shears—Using Partly Worn Zincs—Cost of Operating Electric Cooking and Heating Devices—Electrically Operated Door Locks—Replacing Defective Fuses—Simple Attachment Plugs—Controlling One Lamp From Two Points—Home-Made Night Light—Drop Light Adjusters.

In a treatise of this kind, one cannot expect to give detailed information that will make an electrician out of the average man, but there are many little electrical jobs that can be done by the home mechanic even though he is not versed in all phases of electrical science. In this chapter, the various electrical jobs one could expect to do around the home are described and illustrated, but no instructions are given for power motor installation because such work calls for a licensed electrician, as does house wiring for lighting. Bell and annunciator work is easily performed without danger, so it is gone into in some detail.

Electric Bell and Annunciator Wiring.—One of the most frequent electrical jobs of the handy man around the house is tracing out trouble in bell wiring circuits, or in installing call bells or annunciators to supplement those already in the house. It is often necessary to

install a bell in an upstairs bedroom, with a push button downstairs or to rig up various forms of alarms, and a knowledge of simple wiring will be found advantageous in many ways. The parts of an electric bell system are simple and not hard to understand. For a simple circuit, one needs batteries which are a source of current, a push button switch to control the electrical flow, wires over which the electricity can pass, and bell or annunciators in which the electricity performs useful work.

Push Button Construction.—The construction of a simple push button switch is clearly shown at Fig. 44, A. This consists of a base block of wood or other insulating material to which a metal contact strip is attached, which lies flat on the base and also a contact spring which is normally out of contact with the lower strip, unless it is pressed down against it by a push button. The push button is always made of insulating material. In the cheaper switches, wood or hard rubber is used; in more expensive ones, ivory is sometimes employed. It will be evident that when the spiral or curved spring is brought in contact with the strip on the face of the switch, that the circuit will be closed and current can flow through as long as the push button is kept pressed down. As soon as the pressure is released from the push button, the contact spring has sufficient elasticity to keep the push button pressed up and it is no longer in contact with the lower spring. On account of the air space existing between the springs, no current can pass and the circuit is broken.

When trouble is experienced with an electric bell, if the push button is installed in an exposed place, it is important to unscrew the cover and make sure that the contact springs are not corroded and that a clean, metallic surface is present at the contacts. The wires

should also be tested at the point where they join on to the metal strips in the switch, as the screws holding them may be loose.

Electric Wires and Wiring.—The various wires that are used in electrical installations for both lighting or bell work differ according to the amount of voltage and amperage of the current passing over them. Wires to be used in a lighting circuit of 110 volts or 220 volts pressure, must be more heavily insulated than those which carry only a few volts, such as used in bell ringing or annunciator circuits. Wire ordinarily known as "bell wire" may be purchased at any hardware store, wound on spools of various capacity. This gauge is No. 16 or No. 18, and it is a single strand of copper covered with wax thread insulation. Sometimes this bell wire may be obtained in duplex or other multiple strand cables. The wire used for lighting purposes is usually a twisted cord having a multiple strand conductor, which is protected by both rubber and woven fabric insulation.

Bell wire may be obtained with insulation of various colors and combinations of outer covering weaves, so that in running a number of circuits where the separate wires must run along together, it is possible to recognize the various wires of a circuit by their difference in insulation when these are all brought out at a common point. If this were not done confusion with other wires might otherwise exist in making a connection. The method of holding the wiring in place is very simple. Twisted cord, or as it is sometimes called, "twisted pair," may be held by special tacks having an insulating head as shown at Fig. 44, B, by fibre cleats held by nails or screws, as outlined at Fig. 44, C, and by staples shown at D, or staples provided with a fibre saddle as shown at E. Wherever wires carry currents of moderately high voltage, this fibre

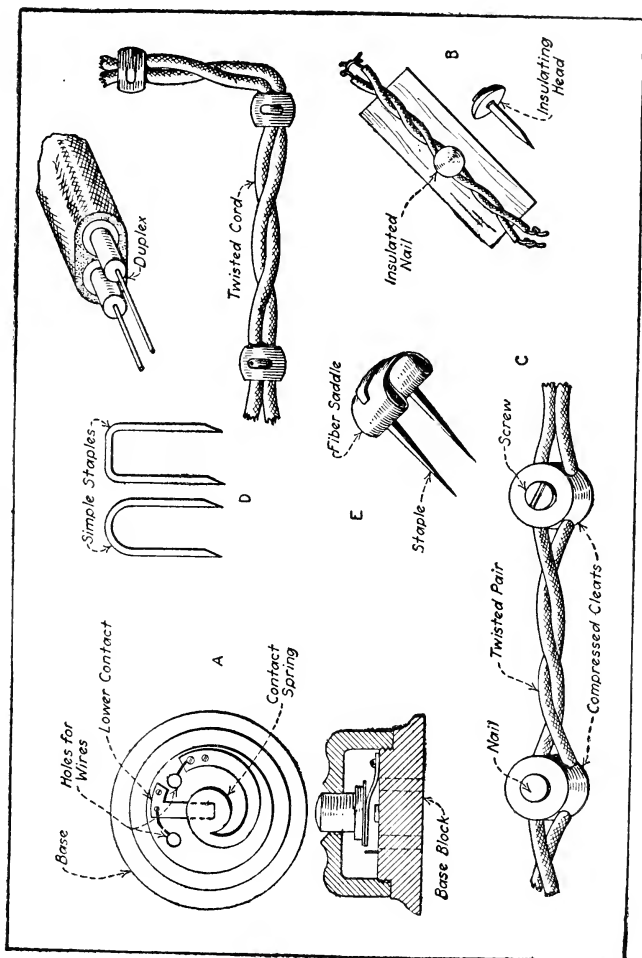


Fig. 44.—Push Button Switch Construction Shown at A. Wiring and Staples for Holding It in Place Shown in Other Drawings.

should always be interposed between the wire and the staple as shown at Fig. 44, E.

The simple staples are not recommended even for bell work unless they are carefully driven down, for, if they are put in place with heavy hammer blows, they are apt to cut through the insulation and even break the wires. The former may cause a short circuit, the latter will surely result in an open circuit. In running wires on old work, advantage is taken of door frames, picture mouldings and other interior trim to conceal the wires. In new work it is evident that they may be run before the plastering is done and this can be properly concealed.

Simple Batteries.—The batteries used to supply electricity are of the open circuit type and operate on the same principle, even though they differ materially in construction as shown at Fig. 45. The wet cell, or modified Leclanche, has long been popular because of its cheapness and simplicity, and the ease with which the elements may be cleaned and solution renewed. It consists of a carbon cylinder as outlined at A, having a boss on one side through which the terminal post passes, and a hole at the center to receive a porcelain insulator that supports the zinc stick and keeps it from electrical contact with the carbon. The carbon cylinder is flanged to fit into a suitable glass jar. The solution is ammonium-chloride or sal-ammoniac and water. The charge is about 3 ounces salt to three-quarters the contents of the battery jar of water. When the current output becomes weakened from a cell of this kind, it is usually due to the electrolyte becoming weak through crystallization of the salt, or the zinc stick being eaten away.

The cell may be restored to efficiency by removing the old solution and crystals deposited in the jar and on the carbon cylinder by thorough washing in warm

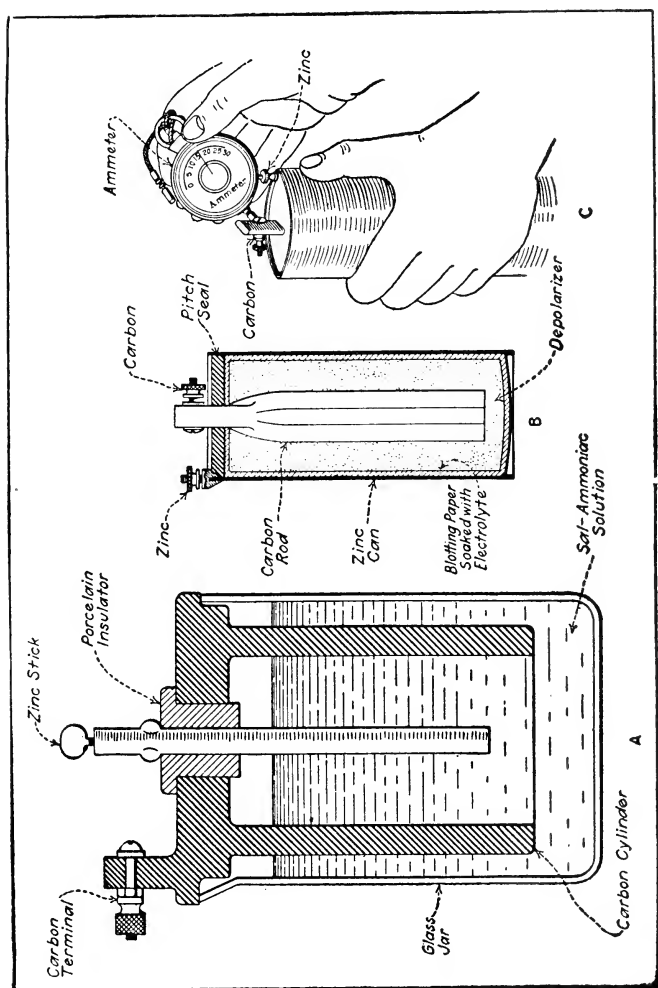


Fig. 45.—Sal-Ammoniac Cell Used for Bell and Annunciator Work Shown at A. The Dry Cell is Shown at B and Method of Testing With Amperemeter at C.

or hot water. The carbon cylinder is then scraped inside to secure a good surface and set in the sun until dry. A new solution is made to which is added a tablespoonful of cane sugar, which prevents or reduces the deposition of salt crystals, a new zinc stick is inserted in the carbon cylinder and the whole placed in the jar. The terminals of both carbon and zinc stick should be bright and clean and the wire brightened where fastened to the terminals, by scraping off any shreds of insulation or particles of wax adhering to it, and having a clean, bright copper in contact with the terminal screw or nut.

Dry Cell Batteries.—A cleaner and more convenient type of current producer is becoming popular for bell ringing and other household demands for intermittent supply such as annunciators, alarms, etc. This is known as a dry cell and consists of a zinc can, in the center of which a carbon rod is placed as shown at Fig. 45, B. The electrolyte is held close to the zinc or active member by an absorbent lining of blotting paper and the carbon rod is surrounded by some depolarizing material. The top of the cell is sealed with pitch to prevent loss of depolarizer.

The depolarizer is needed that the cell may continue to generate current. When the circuit of a simple cell is completed the current generation is brisker than after the cell has been producing electricity for a time. While the cell has been in action the carbon element becomes covered with bubbles of hydrogen gas, which is a poor conductor of electricity, and tends to decrease the current output of the cell. To prevent these bubbles from interfering with current generation, some means must be provided for disposing of the gas. In dry cells, the hydrogen gas that causes polarization is combined with oxygen gas evolved by the depolarizing medium and the combination of these

two gases produces water which does not interfere with the action of the cell. Carbon is used in a dry cell because it is a cheap and satisfactory inactive material, and the electrolyte is a mixture of sal-ammoniac and chloride of zinc, which is held in intimate contact with the zinc shell which forms the active element, by a blotting-paper lining.

Wiring Dry Cells. A single dry cell will not produce sufficient current to ring a bell energetically, therefore it is common practice to combine two or more cells in such a manner that batteries are formed which will give more power than a single cell. If it is desired to increase the voltage, the cells are connected in series. If one dry cell will produce one and one-half volts, and three volts are needed, the current value of one dry cell is augmented by coupling one more to it in a series connection. When cells are connected in series it is the unlike elements which are joined together. For example, the zinc of one cell should be joined with the carbon of the adjacent member by a flexible conductor. This will leave the carbon of one end cell and the zinc of the other end cell free, so that they can be joined to the apparatus in the outer circuit.

When it is desired to obtain more amperage or current quantity than could be obtained from a single cell, as in lighting, they are joined in series-multiple connection. With this method of wiring two or more sets of any reasonable number of cells, which have been joined in series are used. The zinc of one set is joined with the zinc element of the others and the carbons are similarly connected. Any number of sets of cells may be connected in series-multiple, and the amperage of the combination is increased proportionately to the number of sets joined together in this manner.

When either dry or wet cells are connected in series, the voltage of one cell is multiplied by the number of cells and the amperage obtained from the set is equal to the amperage of one cell. When connected in multiple, the amperage is multiplied by the number of cells so joined, but the voltage is that of one cell.

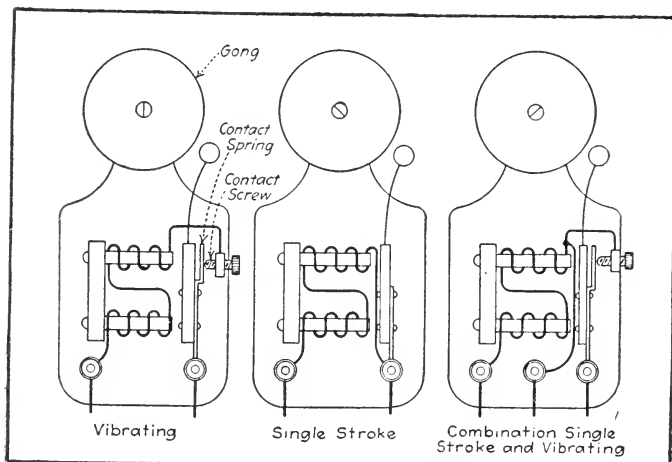


Fig. 46.—Wiring Connections of Three Different Types of Electric Alarm Bells.

When the amperage of a dry cell, tested by a small meter as shown at Fig. 45, C, is less than four or five amperes it should be discarded and a new one supplied, because there is no really economical method of recharging them.

Electric Bell Construction.—The electric bells that are used are very simple in construction. An electro-magnet attracts the armature, to which a clapper or striking rod that hits the gong is attached. When a current of electricity passes through the bell, it energizes the magnet which attracts the armature, causing

the clapper to ring the bell. The vibrating bell, such as shown at Fig. 46, A, is a type only used for alarm purposes. The wiring is very clearly shown in the diagram. The armature spring serves to convey the current from one terminal through a platinum tipped contact screw to the winding around one leg of the magnet. From that point the current flows to the coil around the other leg of the magnet and from that to the remaining terminal on the bell base.

The reason the bell vibrates is due to the automatic breaking of the circuit, which is accomplished when the armature is attracted by the magnet. As soon as this happens, the contact is broken at the adjustable screw, the magnet ceases to attract the armature which flies back because of the spring and again comes in contact with the screw. Naturally, as the current can again flow through the magnet windings, the magnet cores are again energized and will attract the armature. Each time that the armature is attracted, the striking hammer will give the gong a blow and usually the adjustment is such that the armature will vibrate many times a second.

The single stroke form of bell, which is shown at Fig. 46, B, has no contact screw and does not vibrate. It strikes the bell once for each time the push button is pressed down. For this reason it is well adapted for code signaling purposes. The combination form of bell, which is shown at Fig. 46, C, has three terminals and is wired in such a way that it may be employed either as a single stroke bell through one push button, and as a vibrating bell if operated through another button.

Simple Bell Circuits.—A variety of bell circuits are shown at Fig. 47. That at A is the simplest and consists merely of a push button and battery in series with the bell. When the push button switch is oper-

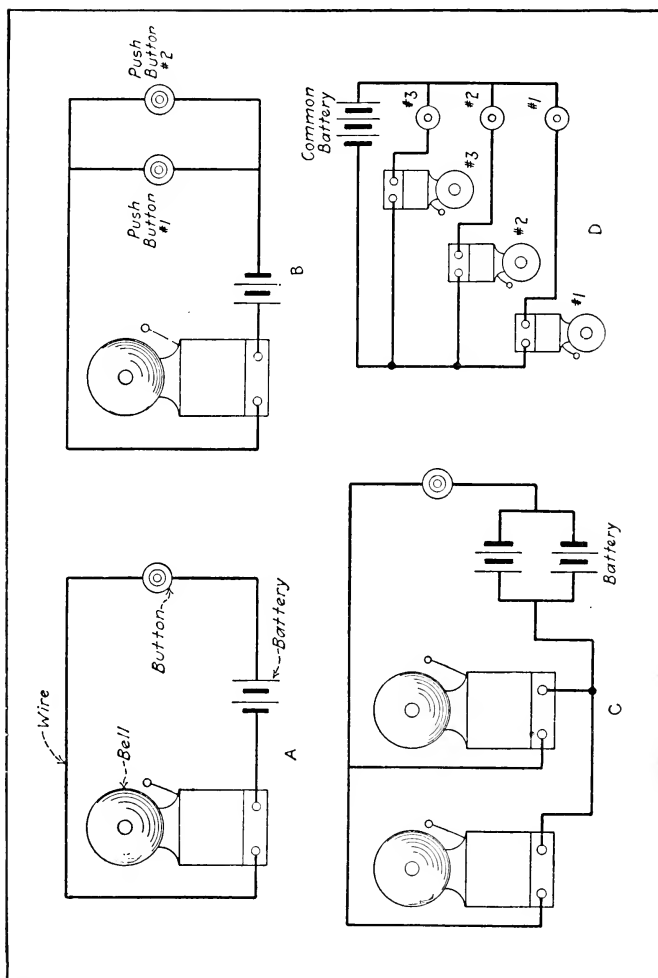


Fig. 47.—Call Bell Circuits, the Simplest Being Shown at A. B—Ringing One Bell From Two Points. C—Ringing Two Bells From One Point. D—How One Battery Can Serve Three Circuits.

ated, the circuit for the passage of electricity is complete and the bell will ring. By placing two push buttons in parallel connection as shown at Fig. 47, B, it is possible to operate the bell from two different places. If it is desired to actuate two bells with one push button, the circuit is as outlined at Fig. 47, C. In this case, the bells are in parallel connection, though

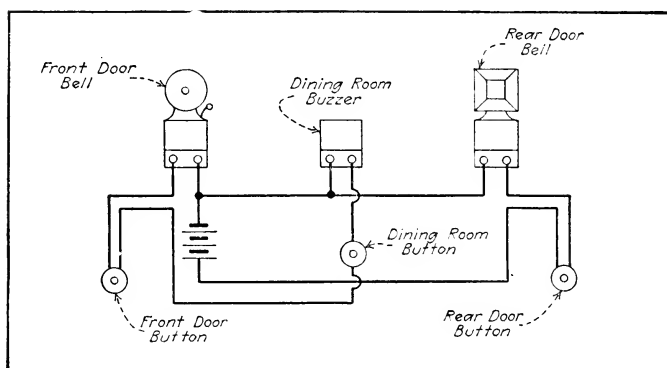


Fig. 48.—The Conventional Domestic Call Bell Installation Shown by Simplified Diagram.

each bell is in series with the battery and push button. When it is desired to operate two or more bells, each with its own push button control, the circuits may be arranged as shown at Fig. 47, B.

Conventional Domestic Installation.—The usual domestic installation is as shown at Fig. 48. Two bells and a buzzer are provided, all of which are placed in the kitchen or pantry. One control button is used to ring the front door bell; one is installed at the back door to ring the bell having a square gong, so as to give it a different tone and the push button controlling the dining room buzzer is generally in the form of a foot controlled switch, placed under the rug

where it can be operated without difficulty by the head of the family. The wiring involved is very clearly shown and, while all parts of the system are grouped completely in the diagram, it will be evident that any of the wires shown may be extended as much as necessary to establish the desired connection between the parts comprising the circuit. Two dry batteries or wet cells, such as shown at Fig. 45, may be used if the wiring is not unusually long, and it is safe to say, that three bells at the most will furnish sufficient voltage for any ordinary domestic installation. For a short run, or where the bell is not a loud ring-

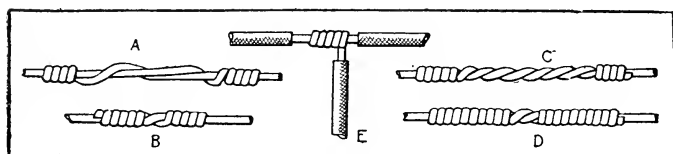


Fig. 49.—Different Methods of Joining Electric Wires to Obtain Good Electrical Conductivity and a Strong Joint.

ing form, or for operating a simple buzzer circuit from one room to another, one cell will be found adequate in most cases.

Joining Wires.—The connections between wires are usually made by stripping the ends to be joined of insulation, cleaning the copper wire thus exposed, with emery cloth, or scraping it with a knife so that the oxide or film is removed from the surface, and then twisting the two wires together to form any of the joints shown at Fig. 49. While these joints are not usually soldered, as is advisable when running long circuits, it will be found advantageous to solder them, as a better electrical contact is obtained and the resistance of the circuit is materially reduced, which

means that more of the current produced by the battery will flow through the device to be operated. After the joint has been made, it is covered with a winding of electrical tape, which acts as insulation. When joints are made in wires conveying lighting current, they are further protected by a layer of rubber tape before the ordinary frictioned fabric, or electrical tape is wound around, and then the joints are

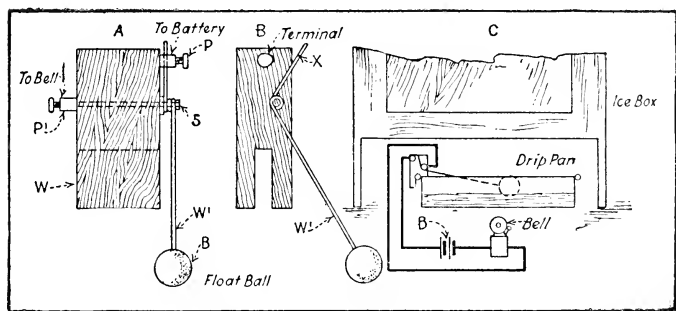


Fig. 50.—How to Make an Overflow Alarm for the Radiator Drip Pan.

painted with an insulating varnish to insure absolutely against leakage of current.

Overflow Alarm.—The drip pan that is placed under the refrigerator often overflows during hot weather because the ice melts more rapidly than expected and the pan is not emptied when it becomes full. The device shown at Fig. 50 is a very simple one that may be easily constructed by the home mechanic and which will save considerable annoyance. The base piece is made of a piece of wood with a notch cut in the bottom so it may be attached to the side of the pan. The float is made of light wood or cork that is attached to one end of a bent wire which is a loose fit on a bearing screw so the cork may move

up and down. Two binding posts or terminals are attached to the wood base, one of these being in connection with the wire that carries the float ball, the other serving merely as an anchorage for one of the circuit wires. The installation of the device is clearly shown at Fig. 50, C. When the water rises, the float ball will also rise, and when the danger-point is reached the bent portion, or short arm of the wire to which the float is attached, will come in contact with the binding post at the top of the board and establish a circuit through the battery and electric bell, which will result in an alarm being given that the water level has reached its maximum permissible height without overflowing.

The bell will continue to ring until the pan is emptied or circuit interrupted. It will be apparent that the water level at which the bell will ring may be altered as required by bending the contact wire, so that it will be in contact with the terminal post only at certain positions of the float. Bending the wire away from the terminal will increase the water level at which the alarm will ring, while bending it closer to the terminal will make the alarm bell ring sooner and for a smaller travel of the float.

Simple Annunciator.—In some circuits one electric bell is operated from two push buttons, and it is not possible to tell which button has operated the bell unless an annunciator is used. The annunciator shown at Fig. 51 is a very simple appliance that may be made by the handy man by using an electric bell magnet and armature which is pivoted at the center instead of at one end, as is usual in practice. An indicator or pointer is attached to the armature, and this moves to the right or left, depending on which magnet of the pair is magnetized. When used in this way, the magnet coils are not joined in series, but each is inde-

pendent of the other. The circuits are very clearly shown, one push button being connected to the bell through one of the magnet coils, while the other can ring the bell only through the other magnet coil. The indicating arm will swing to one side or the other and show clearly which push button has been used to ring the bell.

Electrical Alarm Clock.—A simple method of using an ordinary alarm clock to operate an electric bell,

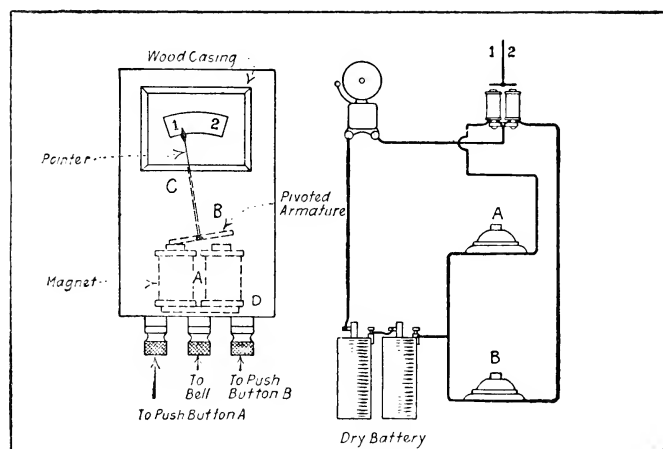


Fig. 51.—Construction of a Simple Two-Way Annunciator.

which will ring until the person it is desired to awaken gets up and shuts it off, is shown at Fig. 52, in the diagram at A. A metal arm or contact is rested on the winding key after the alarm is set. This arm should be of sufficient weight so it will establish a positive contact with the other arm carried below it when the winding key has released it and let it drop. The remainder of the wiring is very simple and it is just as it would be for an ordinary electric bell circuit

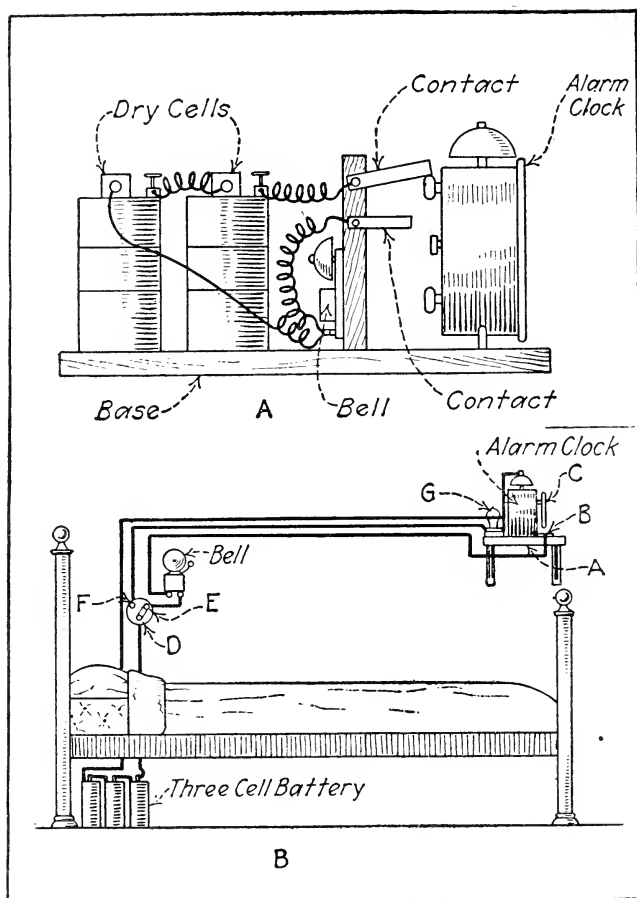


Fig. 52.—Alarm Clock Operated Switch and Simple Bell Circuit Gives a Continuous Ringing Alarm at Any Desired Time.

in which the push button will replace the clock operated switch.

A more complete wiring diagram, which is shown at Fig. 52, B, is so arranged that the electric alarm

may be interrupted without leaving the bed and also a light may be switched on if desired. The alarm clock rests on a suitable shelf which has a contact piece that may be used to establish the circuit when a metal piece is released by the clock winding key as shown at A, Fig. 52. The two point switch and bell are installed near the head of the bed. The switch is normally in such circuit arrangement that when contact is established due to alarm going off, the electric bell will ring, but the switch lever may be moved over to the other contact button when desired, which will turn on a small electric light to illuminate the face of the clock, and thus enable the occupant of the bed to determine the time whenever he desires.

Simple Fire Alarms.—A cheap fire alarm arrangement that will indicate fire at places remote from the house, such as in a barn or storage shed, comprises the usual bell circuit with some form of switch that will automatically make contact either by thermostatic means or by melting of a fusible substance or the burning away of a combustible one. The switch shown at A, Fig. 53, is operated by a weight and is normally held out of contact by a string which passes around a series of small pulleys; this string is anchored at one end and passes through the various rooms where there might be danger of fire. For instance, in a barn the string could pass through a haymow, where any flame would soon char the string, allowing it to become severed and then permitting the weight to drop and establish an electrical contact at the switch. The electric bell is connected in the usual manner, and is placed in the house.

The automatic switch shown at B, Fig. 53, is easily constructed. It is made of a block of wood serving as a base, this having two strips of spring brass attached to it. These springs have contact pieces which

will be pressed tightly together when a piece of beeswax inserted between the ends of the brass strips melts from excessive heat. As soon as the brass strips come together a circuit is established and the bell will ring. A number of these automatic circuit closers may be made and wired in parallel with one bell, so that they may be installed at various points which one desires to protect. If wired through an annunciator, just as push buttons would be, fire in any of several rooms, such as in a storage warehouse, would be im-

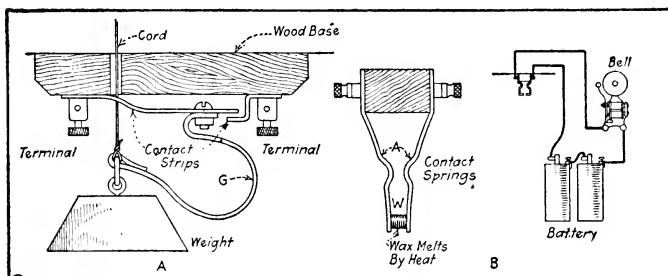


Fig. 53.—Two Forms of Automatic Switches to Use With Bell Circuits and Secure Fire Alarm Advantages.

mediately indicated at some central point by the annunciator.

Simple Terminals.—The suggestions given at Fig. 54, A, shows how a very satisfactory terminal for connecting the ends of wires to batteries or to any electric apparatus having binding posts may be made by using ordinary split pins of the proper size. The end of the wire is passed through the eye of the cotter pin, twisted around itself, and then the pin and wire soldered together and covered with a piece of tape. A connection of this kind is superior to the use of the copper wire, as it is much stronger and the wire is apt to be cut or broken by the pressure of the clamp

screw because of its softness. A better connection is obtained because the legs of the split pin are normally spread apart slightly and will fit the hole in the terminal nicely.

Magnetizing Shears.—A pair of magnetized shears or scissors are a very handy thing for a housewife to have because it will enable her to pick up a needle or steel pin from the floor without difficulty. The method of magnetizing is very simple and may be done with

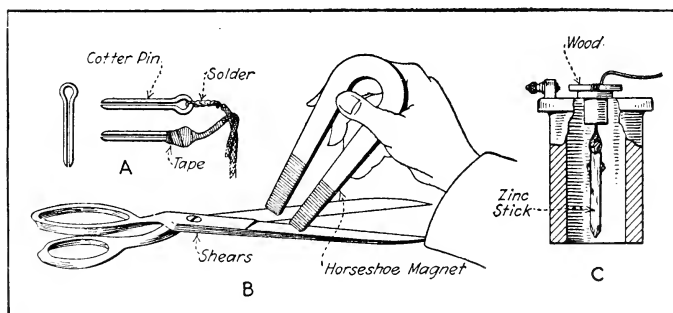


Fig. 54.—How Crotter Pin Can Be Used as a Wire Terminal at A. Method of Magnetizing Shears at B. Using Partially Consumed Zinc at C.

a small horseshoe magnet as shown at Fig. 54, B. The poles of the magnet are placed in contact with the scissors blades near the hinge and are drawn towards the end of the blade. A number of strokes of the magnet are all that is necessary to magnetize the scissors blades. If these are of steel, they will remain permanently magnetized. The only precaution to be observed is to make sure that the same poles of the magnet come in contact with the same blades of the scissors at each stroke of the magnet.

Using Partly Worn Zinc.—A simple way of using a battery zinc that has been partly eaten away is shown

at Fig. 54, C, and serves in an emergency. It is suspended by a wire and after a good connection is made at the binding post the end of the zinc and wire is coated with wax to prevent corrosion, which will otherwise occur from the action of the electrolyte if it were not prevented by the insulation. After the zinc is dropped down into the solution—the proper amount—the wire is twisted around a piece of wood, which is placed across the insulator as shown, to hold it in place.

Cost of Operating Cooking Devices.—The following table compiled by the National Electric Light Association, serves to show how inexpensive the operation of domestic heating and cooking devices, which are now widely used, really is. It must be understood that the cost will vary in different localities according to the rate charged for electric current. The rate of ten cents per kilowatt-hour was used in computing this table:

<i>Devices</i>	<i>Costs per hour</i>
Chafing Dishes	2 to 5.
Cigar Lighters	0.75
Coffee Percolators	1 to 4.4
Flatiron (3 lb.)	2.75
Flatiron (4 lb.)	3.5
Heating pads	0.5
Nursery milk warmers	4.5
Radiators	7 to 60
Shaving mugs	1.5
Stoves (4½ to 12 inches)	0.5 to 13
Toasters (9 in. by 12 in.)	3.2 to 8.8
Toasters (12 in. by 18 in.)	5 to 15
Waffle irons (2 waffles)	7.5

Electrically Operated Door Locks.—Two suggestions for electrically operated door locks are shown at Fig. 55. That at A is a very simple form in which a long bolt is normally kept in the locked

position by means of a weight or small spring and which is unlocked by pressing a push button, which energizes the magnet and which draws the armature or locking bolt out of engagement with the locking screweye. As soon as the pressure on the button is released the long bolt will swing back into locking position. The electric lock shown at Fig. 55, B, is a much stronger method than that shown at A. In this, when the door-locking bolt is pushed into position, it is locked by a trigger member dropping into the notch in the end of the bolt. When the push button is pressed and the circuit completed, the magnet lifts the locking trigger, which permits a withdrawing of the bolt and unlocking the door. The circuits are very simple ones, being practically the same as those used in electrical bell work.

Replacing Defective Fuses.—When the light goes out suddenly in the household, experience has demonstrated that unless the main power supply has failed, that the trouble is undoubtedly due to the blowing of a fuse in the main or one of the branch circuits of the house wiring system. Unless one is sure of the cause of blowing out of the fuse, a new fuse should not be placed in the fuse block without some investigation to determine the reason why the fuse was blown out. The function of the fuse is to act as a safety valve that will protect the circuit against overload by melting, and thus interrupt the current flow. Any short circuit in the wiring system, or in any of the appliances connected to it, will cause a fuse to blow out, though at times some of these “blow” because of depreciation caused by time of the fusible alloy wire in the fuseplug. The construction of the usual fuseplug is clearly shown at Fig. 56, A. This consists of a screw base similar to that used on an incandescent lamp, having the outer shell and the central terminal

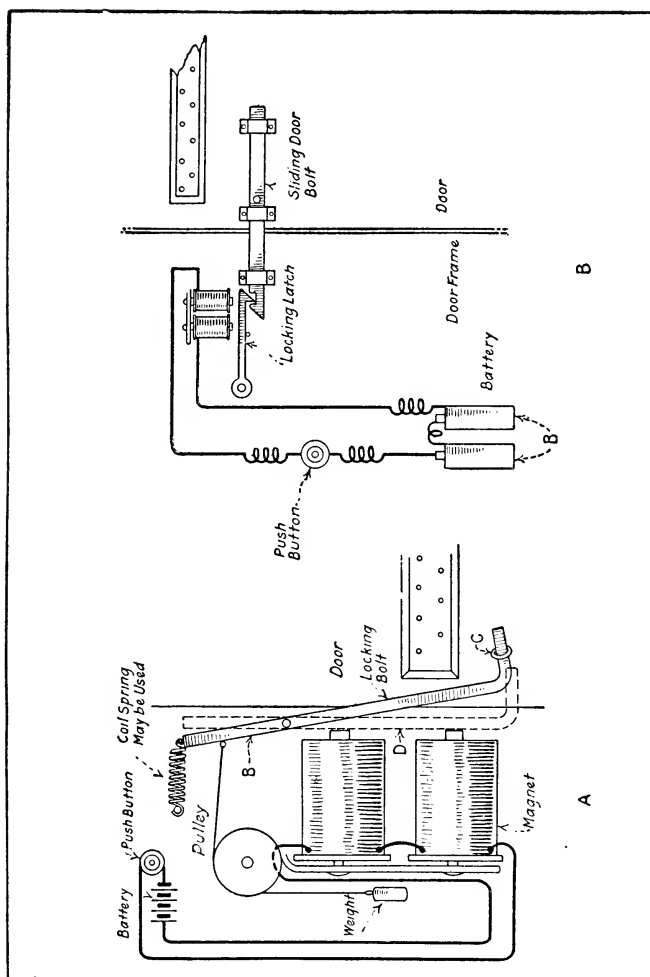


Fig. 55.—Electrically Operated Door Locks.

button joined by a piece of lead alloy wire, which will melt from the heat if more than a certain amount of current passes over it.

A fuse often blows out when a vacuum cleaner or an electric iron is used after dark, because the lights that are operated on a circuit are consuming current almost to the capacity of the fuse and when the electric iron or vacuum cleaner is put in circuit the heavy

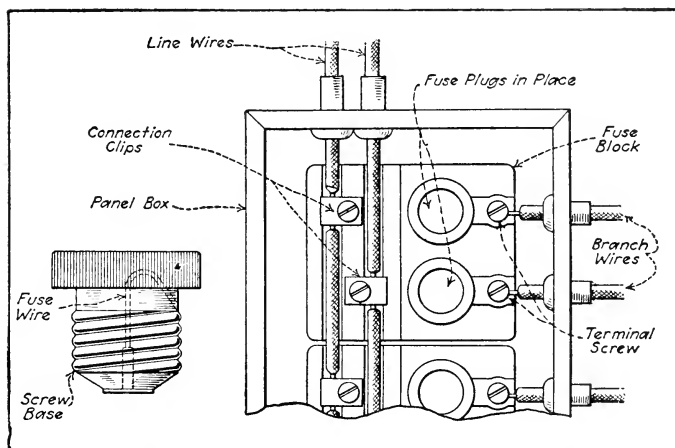


Fig. 56.—Typical Fuse Plug and Panel Box in Which It is Used.

rate of current flow causes the fuse to blow out. Heavier fuses should always be used in lines where appliances other than lamps are apt to be used in conjunction with them.

The usual form of fuse block is shown at Fig. 56, B, with the fuses in place. The top of the fuse is closed in with a piece of mica or isinglass, and when a fuse is blown this is usually blackened so that the interior cannot be seen, otherwise the fuseplug shell interior

can be inspected and the wire binding the two parts of the block can be easily seen. The Underwriters' rules limit the amount of current carried by any branch circuit in household wiring to 660 watts, which means that no more than six amperes can be carried on a circuit of 110 volts, which is that usually employed for lighting purposes. For this reason separate fuses are provided for each branch lighting circuit.

The replacing of a fuse is a simple matter and it is only necessary to unscrew the blown or defective fuse-plug and screw in a new one in its place. This operation is as simple as removing or installing an electric lamp in a socket. If it is impossible to keep a fuse from "blowing" the trouble is due to a short circuit in the wiring, and it should be corrected by a competent electrician before an attempt is made to use the current. Several replacements should be available at all times and should be placed near the panel box so as to be accessible in the event of a fuse blowing out on any of the circuits. The ordinary fuse for household use is rated at five amperes, though they may be obtained in varying capacities, depending upon whether they are used for lighting or power circuits, and also according to the voltage of the circuit.

Simple Attachment Plugs.—It is sometimes necessary to attach an appliance to a lighting fixture when no extension plug is available. Various simple methods of doing this are shown at Fig. 57. The emergency extension plug shown at A is made by using a base from an old lamp, the inside of which is cleaned out thoroughly and one end of a wire attached to the contact button at the center of the porcelain insulator at the base, and the other end secured to a terminal post taken from the carbon of an old dry battery. The other wire is attached to the threaded shell at one

end, and to a terminal post at the other. The inside of the socket is then filled with plaster of paris, which is formed up as indicated, by being poured into a mould made by rolling a piece of paper in cylindrical form and inserting it in the socket shell before the mixture is poured in. This paper mould is also very useful in keeping the terminal screws in place until the plaster of Paris sets. The plaster of Paris is mixed

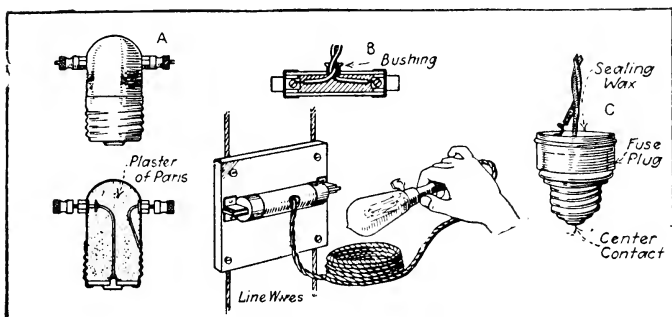


Fig. 57.—A Variety of Attachment Plugs That Can Be Made in the Home Workshop.

with water to form a paste that may be easily poured in the shell and mould interiors.

The attachment plug shown at B is made by drilling a hole in the center of the fibre casing of a cartridge fuse, into which a socket bushing is tightly screwed. The wires are passed through this and are attached to the clips to which the fuse wire would ordinarily be attached. The cover is taken off by prying around the brass ring, which gives access to the interior. The method of using this attachment fixture is also clearly outlined, as simple clip fittings may be secured to a block and interposed to the circuit. One of the wires should be attached to one clip,

the other circuit wire to the other clip, so that when the plug is put in place it is in parallel with the circuit and not in series.

A fuse plug of the screw type may be used for an extension plug by putting a hole in the mica cover that allows joining of one wire to the center contact at the bottom, and the other wire to the brass shell below the knurled part, taking care to solder both wire ends securely against the metal parts they are joined to. The interior of the fuse plug is then filled with

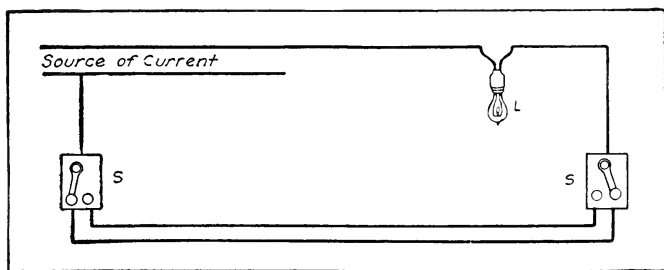


Fig. 58.—Turning On One Lamp From Two Points.

melted sealing wax or with plaster of Paris, to keep the wires from coming in contact with each other and also to hold them firmly in place so they will not come loose.

Controlling One Lamp from Two Points.—The diagram at Fig. 58 shows how one electric light may be turned on and off from two different points. This is especially handy when one wishes to control the light from the top of the cellar stairs, for example, and from the cellar itself. Two point switches are used which are wired in the circuit as outlined. With this arrangement either switch may be used to control the lamp.

Home-Made Night Lamp.—A very effective, yet simple, night lamp may be constructed by the home mechanic by following the suggestions at Fig. 59, A. The base piece as well as the upright may be constructed to any desired wood, painted and finished to suit the taste of the builder. To prevent the base from scratching polished furniture, a piece of felt or flannel or any other suitable cloth may be glued to

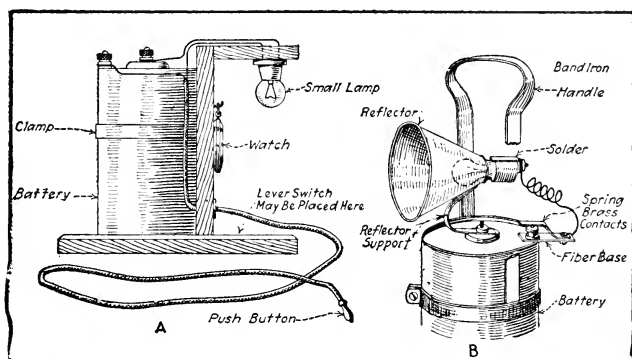


Fig. 59.—A Home-Made Night Lamp at A and a Simple Lantern at B.

the under side of the base. The small battery may be the type used as a recharge for a flash light or may be made up of two small dry cells. The lamp is the ordinary small bulb such as used in a flash light provided with a screw base to fit a miniature socket. Ordinary twisted lamp cord is used to make the circuit, this running to a pear-shaped push button which may be carried to any desired point, or a small one-point switch may be placed on the base instead of the push button. A simple screw hook serves as a hanger for the watch, the face of which is illuminated by the small lamp when the switch closes the circuit.

The home-made lantern operated from a single dry cell of the No. 6 size, which is $2\frac{1}{2}$ " in diameter and 6" long, is shown at Fig. 59, B. A small funnel serves as a reflector, the spout of the funnel being removed. The funnel is attached to the carbon terminal by means of a piece of bent metal soldered to the funnel at one end and having a hole in the other to fit over the carbon terminal screw. The lamp is the

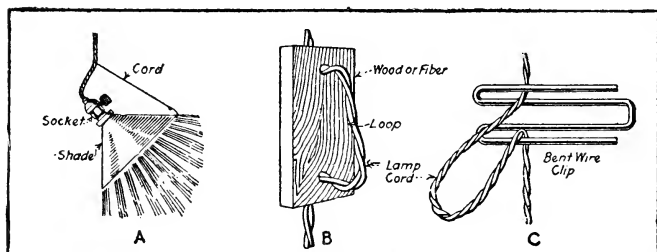


Fig. 60.—Simple Lamp Cord Adjusters of Wood and Wire.

type such as used in an automobile side light and is attached to the funnel by a sheet metal clip.

The switch is made by using a piece of spring brass which is attached to a fiber strip at one end and so shaped as to be brought in contact with the zinc terminal of the battery at the other. The socket of the lamp acts as one terminal by being attached to the funnel, while the center contact is connected to the fiber piece by a short wire as indicated. A suitable clamp and handle is bent up of light sheet metal by which the cell may be carried. The method of construction is clearly shown in the details accompanying the sketch.

Drop Light Adjusters.—A simple method of making an angle drop light is shown at Fig. 60, A. An ordinary piece of cord is tied to a hook, which may be

made of any desired piece of wire, such as a paper clip or a piece of hairpin. The other end of the cord is tied to the lamp cord and, when the hook is looped over the shade, the lamp will be tilted to any angle desired by varying the length of the string. The shade may be inclined so that the light may be directed to any point desired.

Two simple drop light adjusters are also shown at Fig. 60. That at B is made from a piece of wood $\frac{3}{8}$ " thick, $1\frac{1}{2}$ " wide and 3" long. A $\frac{1}{4}$ " hole is bored through about $\frac{1}{2}$ " from each end. The length of the lamp cord may be varied by increasing the size of the loop as desired. A $\frac{1}{4}$ " hole is the proper size to use with an ordinary lamp cord, though it is evident that the holes may be made to any size to accommodate the diameter of the lamp wires. The adjuster shown at Fig. 60, C, consists of a piece of copper or iron wire about $\frac{1}{8}$ " in diameter bent up as indicated. The method of using it is clearly shown in the illustration.

CHAPTER V

HELPFUL RECIPES AND FORMULÆ

Cleaning Waste Pipes—A Superior Whitewash—Silvering Metals—Writing on Steel—Black Lacquer for Metal or Wood—A Good Polish for Brass—Filling for Cracked Ceilings—Filling Cracks in Floors—Fastening an Umbrella Handle—To Frost Glass—To Brighten Silver Plated Articles—To Remove Rust From Steel—Cleaning Marble—Cleaning Paint—Removing Hard Wax and Candle Grease From Cloth—To Remove Soft Grease Spots From Fabrics—Preparation for Cleaning Gloves—Eradicating Ink Stains—Miscellaneous Cements and Adhesives—Marine Glue—Glue to Resist Damp—Rubber Cement—Cement to Mend Crockery—Cements for Pipe Joints—Cement for Iron—Paste for Sticking Paper Labels to Glass, Wood or Metals—Adhesive Material—Alum and Plaster of Paris Cement—Indestructible Writing Ink—Removing Ink Stains From Wood—Preserving Leather—Oiled Dust Cloth—Detection of Gas Leaks—How to Read a Gas Meter—Cleaning Stove Pipes—Varnish for Stove Pipes—French Polish Revivers—Paints for Boiler Fronts.

The handy man is expected to be a compendium of useful information, and if he is known to be mechanically inclined he is the adviser, not only in his own household, but in those of his friends who do not have such ability. He is asked numerous questions, some of which concern mechanical processes, others which deal with various recipes for doing anything from removing grease spots to painting a stove pipe or boiler front with a paint that will not burn off. The collection of recipes and formulæ which follow have been secured from "Henley's Twentieth Century Recipe Book,"* for the most part, and are

* Published by the Norman W. Henley Pub. Co., 2 West 45th Street, New York City. Price, \$4.00.

believed to contain considerable information that will be of value to the handy man, because they give suggestions that can be applied to advantage around the home.

Cleaning Waste Pipes.—One of the frequent annoyances of housekeeping is the obstruction to the free, quick outlet of the waste water of the washstand, the bath-tub and the kitchen sink. This results from a gradual accumulation of small bits of fatty material, paper, lint, meat, bones or other offal which check and finally entirely stop the outflow of the waste water. The plumber is called and usually removes the stoppage with his force-pump. Sometimes this is effective; at others the offending waste-pipe is cut out and a new one put in its place at considerable cost.

A simple, inexpensive method of clearing the pipe is as follows: Just before retiring at night pour into the pipe enough *liquid* potash (not soda) lye of 36° strength to fill the "trap," as it is called, or bent portion of the pipe just below the outlet. About a pint will suffice for a washstand, or a quart for a bath-tub or kitchen sink. Be sure that no water runs into it till next morning. During the night the lye will change all of the offal in the pipe into *soft soap*, and the first current of water in the morning will remove it entirely, and leave the pipe as clean as new. Two applications of the lye should be enough to cure any case. The so-called potash lye sold in small tin cans in the shops is not recommended for this purpose; it is quite commonly misnamed, and is called *caustic soda*, which makes a hard soap. That may block up the pipe even worse than the material it was desired to remove.

A Superior Whitewash.—For a useful lime wash for wood and stone the following method of prepara-

tion is given by an expert. Twenty quarts of quicklime are slaked in a suitable vessel with as much hot water as will stand at a level of 6 inches above the lime. The milk of lime is diluted, and first 15 grains of sulphate of zinc and then 7 grains of common salt are added. The latter causes the lime wash to harden without cracking. A beautiful cream color can be imparted to the mass by putting into it 7 grains of yellow ocher, or a pearly tint by addition of some lampblack. A fawn color is produced by two grammes of umber and 7 grains of lampblack. A stone color can be obtained from 30 grains of umber and 7 grains of lampblack. The color is applied, as usual, with a large, flat brush.

Silvering Metals.—Small articles may easily be coated with silver by dipping them first into a solution of common salt and rubbing with a mixture of one part of precipitated chloride of silver, two parts of potassa alum, eight parts of common salt, and the same quantity of cream of tartar. The article is then washed and dried with a soft rag.

Writing on Steel.—Steel can be written on or engraved for marking tools by first cleaning it with oil and then spreading a coating of melted beeswax upon it. The writing can then be done on the beeswax, with any sharp instrument, and the lines and marks thus made should be painted with a fine brush dipped in a liquid made of one ounce of nitric acid and one-sixth of an ounce of muriatic acid. When the written lines are filled with this liquid, it should be allowed to remain five minutes, and then the article should be dipped in water and wax removed and steel cleaned.

Black Lacquer for Metal or Wood.—Nine parts of shellac are dissolved in fifty parts of methylic alcohol and set aside for a few days. Then ten parts of pulverized asphaltum are dissolved in fifty parts of coal

tar benzine. Both liquids being mixed, a sufficient quantity of lampblack is added to give it the required density. When necessary, it may be diluted with a mixture of alcohol and benzine.

A Good Polish for Brass.—For polishing bright brass work rub the surface of the metal with rottenstone and sweet oil, and then rub off with a piece of cotton flannel and polish with soft leather. A solution of oxalic acid rubbed over tarnished brass soon removes the tarnish, rendering the metal bright. The acid must be washed off with water, and the brass rubbed with whiting and soft leather. A mixture of muriatic acid and alum dissolved in water imparts a golden color to brass articles that are steeped in it for a few seconds.

Filling for Cracked Ceilings.—Whiting mixed with glue water or calcined plaster and water makes a good putty for filling cracks in plastered ceilings or walls. The filling material is in the form of a paste and is worked into the crack with a putty knife.

Filling Cracks in Floors.—Cracks in floors can be neatly and permanently filled with a paste made by soaking newspapers, $\frac{1}{2}$ lb. of flour, 3 qts. of water and $\frac{1}{2}$ lb. of alum thoroughly mixed and boiled. The mixture acquires the consistency of putty, and when forced into the cracks of the floor it will harden similar to papier-mache and will resist wear as well as wood and prevent dirt getting into the cracks.

Fastening an Umbrella Handle.—Sometimes a person would like to change a good umbrella handle from a discarded one to another umbrella and fasten it on solidly. This is done by cleaning out the hole left in the handle from the old rod and then filling the hole with flour of sulphur. Place the handle firmly in an upright position. The umbrella rod is heated red hot and pushed down into the hole con-

taining the sulphur. The heat fuses the sulphur and when cold it will hold the rod solidly. This method may be applied to fastening rods into stone, iron or wood, and also for holding knives and forks into bone or other similar handles.

To Frost Glass.—The following process can be used for lights of glass already set in the sash. Dissolve 1 part of wax in 10 parts of oil of turpentine and add 1 part each of varnish and siccative. With this mixture the panes are coated on the outside, and before drying dabbed with a pad of cotton wadding. If desired, small quantities of Paris blue, madder lake, etc., may be mixed with the wax solution, which will make the frosting a corresponding color. This is a good method of frosting lamp bulbs.

To Brighten Silver-Plated Articles.—Articles of silver and silver-plated ware rapidly tarnish when kept in rooms where gas is used for illuminating purposes, and anywhere in manufacturing cities, where the air is constantly filled with sulphurous vapor. This may be avoided by dipping the articles occasionally in a solution of hyposulphite of soda. Large articles, like pitchers and salvers, should be wiped off with a rag dipped in the solution, and dried with a soft towel. A rub with a bit of chamois leather makes them as brilliant as new.

To Remove Rust from Steel.—Place the article in a bowl containing kerosene oil, or wrap the steel up in a soft cloth well saturated with kerosene; let it remain 24 hours or longer; then scour the rusty spots with brickdust. If badly rusted, use salt wet with hot vinegar; after scouring, rinse every particle of brickdust or salt off with boiling hot water; dry thoroughly; then polish off with a clean flannel cloth and a little sweet oil or "3 in 1" oil.

Cleaning Marble.—A paste formed of whiting and benzine will cleanse marble from grease, and one made of whiting and chloride of soda, spread and left to dry, in the sun if possible, on the marble will remove stains.

Cleaning Paint.—(1) To clean paint, take 1 oz. powdered borax, 1 lb. small pieces best yellow laundry soap, and 3 quarts water; simmer till the soap is dissolved, stirring frequently, and take care not to have the mixture come to a boil. Use with a piece of old flannel, and rinse off as soon as the paint is clean. This mixture is good for washing clothes.

(2) Take a pail of hot water; throw in two tablespoonfuls of powdered borax; use a good coarse towel and wash the painting; do not use a brush; when washing places that are extra yellow and stained, soap the cloth; then sprinkle it with the dry powdered borax, and rub the places well, using plenty of rinsing water. In washing the woodwork in this way, the paint will not be injured and the borax will soften and make the hands white—a fact well worth knowing.

Removing Hard Wax and Candle Grease from Cloth.—Rub and scrape off as much of the wax as possible; hold a hot poker or a burning match as near the cloth or fabric as possible, without igniting it, and the wax will melt and sink into the fabric and disappear. This does not really remove it. A far better way is to place a piece of good blotting paper over the stain and press it with a hot iron, shifting the blotting paper two or three times if the spot is large. The wax melts and a large proportion is absorbed by the blotting paper.

To Remove Soft Grease Spots from Fabrics.—Sponging with benzine, ether, or chloroform is generally recommended, and, as usually effected, ends in

the production of a ring-shaped stain. To avoid this proceed as follows: Moisten the cloth all around the stain with the benzine or other solvent, making a complete ring, and giving it all the liquid it will take up. Now work inwards towards the stain, and eventually sponge it off, and if desired apply dry blotting paper to remove the surplus. A sponge should be used, as it acts in a double capacity, applying the solvent when squeezed and reabsorbing it and the grease with it when relaxed. An excellent way of applying the ring of liquid is to use a piece of blotting paper, circular, and perforated with a hole slightly larger than the spot of grease. This is laid upon the cloth and the solvent is poured upon it.

Preparations for Cleaning Gloves.—Six parts of soap are dissolved in 2 parts of water; 4 parts of Javelle water and $\frac{1}{4}$ part of aqua ammonia are added. The glove is sponged off with this liquid. As a simpler application, the gloves while on the hand may be rubbed with bread crumbs or India rubber sponge eraser as used by draftsmen for cleaning drawings.

Eradicating Ink Stains.—Pyrophosphate of soda is recommended for the removal of ink stains. This salt does not injure vegetable fiber and yields colorless compounds with the ferric oxide of the ink. It is best to first apply tallow to the ink spot, then wash in a solution of pyrophosphate until both tallow and ink have disappeared.

Miscellaneous Cements and Adhesives, Marine Glue.—(1) Caoutchouc, 1 oz.; genuine asphaltum, 2 oz.; benzole or naphtha, q. s. The caoutchouc is dissolved by digestion and occasional agitation, and the asphaltum is gradually added. The solution should have about the consistency of molasses.

(2) Dissolve 1 part of India rubber in 12 parts of benzole, and to the solution add 20 parts of powdered

shellac, heating the mixture cautiously over a fire. Apply with a brush.

Rubber Cement.—Digest caoutchouc, cut in fine shreds, with about 4 volumes of naphtha in a well-covered vessel for several days. Naphtha should not be used indoors. Keep the cement in a tightly corked bottle to avoid evaporation of the volatile solvent.

Glue to Resist Damp.—A glue to resist damp can be prepared with boiled linseed oil and ordinary glue; or by melting 1 lb. of glue in 2 qts. of skimmed milk and adding shellac, 4 ounces; borax, 1 ounce, boiled in a little water, and concentrated by heat to form a paste.

Cement to Mend Crockery.—One of the strongest cements, and easily applied for this purpose, is lime and the white of an egg. To use it, take a sufficient quantity of the egg to mend one article at a time, shave off a quantity of lime, and mix thoroughly. Apply quickly to the edges and place firmly together, when it will very soon become set and strong. Mix but a small quantity at once, as it hardens very soon so that it cannot be used. Calcined plaster of Paris would answer the same purpose as lime.

Cements for Pipe Joints.—The following are cements for steam and water joints: (1) Ground litharge, 10 pounds; plaster of Paris, 4 pounds; yellow ochre, one-half pound; red lead, 2 pounds; hemp, cut into one-half inch lengths, one-half ounce; mixed with boiled linseed oil to the consistency of putty.

(2) White lead, 10 parts; black oxide of manganese, 3; litharge, 1; mixed boiled linseed oil.

A cement for joints to resist great heat is made thus: Asbestos powder, made into a thick paste, with liquid silicate of soda.

Cement for Iron.—The following cement is recommended for repairing damaged places in iron castings:

5 parts brimstone, 2 parts black lead, and 2 parts cast-iron filings (previously sifted) are melted together, taking care that the brimstone does not catch fire. The damaged place should be perfectly dry, and well heated by laying a piece of red-hot iron upon it, and is then stopped with the cement, previously heated in a melting-ladle till it becomes soft.

Paste for Sticking Paper Labels to Glass, Wood, and Metals.—The mixture is composed of starch, 2 dr.; white sugar, 1 oz.; gum arabic, 2 dr.; water as required. Dissolve the gum, add the sugar, and boil until the starch is cooked.

Adhesive Material.—This is made of water, 1 oz.; methylated spirit, 2 oz.; dextrine, 2 tablespoonfuls. Mix the water and spirit; stir in the dextrine to produce a smooth paste, and place the vessel in which the ingredients have been mixed in hot water till a clear brown solution results.

Alum and Plaster of Paris Cement.—Alum and plaster of Paris, mixed with water and used in liquid state, form a hard composition and a useful cement for filling cracks in plaster, china, etc.

Indestructible Writing Ink.—It is said that an ink that cannot be erased even with acids is obtained by following this receipt: A strong solution of fine soluble Prussian blue in distilled water is added to good gall ink. This addition makes the ink, which was previously proof against alkalies, equally proof against acids, and forms a writing fluid which cannot be erased without destruction of the paper. The ink writes greenish blue, but afterward turns black.

Removing Ink Stains from Wood.—Mix 8 ounces concentrated sulphuric acid and $1\frac{3}{4}$ pints of water carefully, and allow it to stand until cool, taking care to pour the acid slowly into the water, stirring meanwhile. Scour the stain with water and sand thor-

oughly, and then pour some of the mixture upon it and rub until the stain has disappeared.

Preserving Leather.—(1) Equal parts of mutton fat and linseed oil mixed with 1/10 their weight of Venice turpentine, and melted together in an earthen pipkin, will produce a “dubbin” which is very efficacious in preserving leather when exposed to wet or snow, etc. It should be applied when the leather is quite dry and warm. (2) Many other formulæ exist for dubbins, but all contain essentially the same ingredients. (3) A solution of 1 oz. solid paraffin in 1 pint light naphtha, to which 6 drops sweet oil have been added, is put cold on the soles, until they will absorb no more. One dressing will do for the uppers. This process vastly increases the tensile strength of every stitch; and, while not removing the natural moisture of the leather, decidedly waterproofs the boot. The sole lasts two months longer when so treated. (4) There is nothing like castor-oil for preserving leather. Applied once a month, or once or twice a week in snowy weather, it not only keeps the leather soft, but makes it waterproof. Copal varnish is the best thing to apply to the soles, but the latter should be thoroughly dry and, if they have been worn, they should be previously roughed on the surface before applying the varnish.

Oiled Dust Cloth.—Saturate a suitable piece of cloth with kerosene, and lay it aside until the surplus oil has evaporated. Rub it on a wooden surface until it no longer leaves a streak, and it is ready for use. This cloth should be well shaken after each use, and re-oiled about once a month. Another method is to mix 30 parts of kerosene with 10 parts of double refined rapeseed oil, heat moderately and stir into it 1 part of melted benzine. Immerse the cloths in this liquid until they become entirely saturated with it;

wring out well, and dry in a shady place. The cloths do not injure even polished furniture, but rather enhance the brilliancy.

Detector of Gas Leaks.—By far the best test is to rub a little soapy water upon the suspected place. The formation of a bubble will show where the leak is. Never look for a gas leak with a naked flame, and

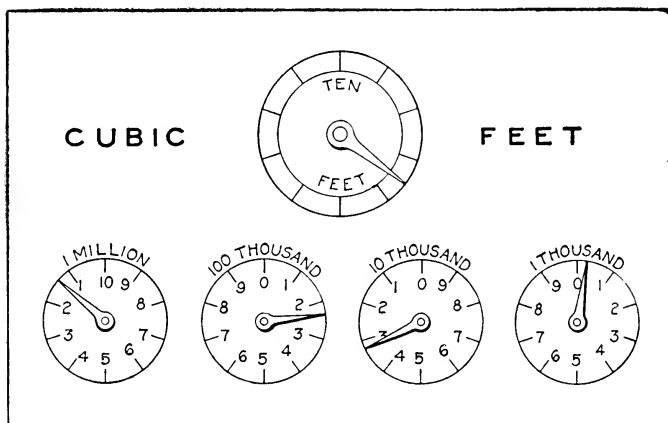


Fig. 61.—Dials of Typical Gas Meter Showing Method of Reading as Described in Text.

just as soon as a leak is detected open the windows of the room to insure adequate ventilation until the leak is found.

How to Read a Meter.—The dial marked “1 thousand” in the accompanying illustration, Fig. 61, is divided into hundreds; the dial marked “10 thousand” is divided into thousands; that marked “100 thousand” into ten-thousands, and that marked “1 million” into hundred-thousandths. When 1,000 cu. ft. of gas have been consumed the pointer on the dial marked

1 thousand will have made a complete rotation, and the fact will be indicated by the pointer of the next dial at the left, which will point to the figure 1. When 10,000 cu. ft. of gas have been consumed the pointer on the "10 thousand" dial will point to 1 and so on. In reading a gas meter, put down the hundreds first, then the thousands, and so on, always counting the figure just under or which has just been passed by the pointer. In the illustration about half a hundred is indicated on the "1 thousand" dial, three thousand is indicated on the next dial, and one hundred thousand on the "1 million" dial. The reading will be 123,050. The dial marked "ten feet" is called the units dial. It is used for testing the meter to discover whether it is in working order or not. Each mark represents a cubic foot and the complete circle 10 cubic feet. If the pointer moves when no gas is burning, it indicates a leak. If it does not move when the gas is burning, or if its motion is unsteady, it indicates a derangement in the mechanism and shows that the meter requires attention.

Stove Pipes.—The fumes from a piece of zinc put on the live coals in the stove will clean out the stove pipe. A stove pipe may be protected by using a varnish composed of asphaltum, 2 lbs.; boiled linseed oil, 1 pt.; oil of turpentine, 2 qts.; melt the asphaltum in an iron pot, boil the linseed oil and add to the asphaltum while hot. Stir well and remove from the fire. When partially cooled, add the oil of turpentine.

French Polish Reviver.—Linseed oil, $\frac{1}{2}$ pt.; spirits of camphor, 1 oz.; vinegar, 2 oz.; butter of antimony, $\frac{1}{2}$ oz.; spirit of hartshorn, $\frac{1}{4}$ oz. Mix together and apply with a cloth. Another mixture recommended is naphtha, 1 lb.; shellac, 4 oz.; oxalic acid, $\frac{1}{4}$ oz. Still another is made as follows: $\frac{1}{2}$ gill of vinegar, 1 gill spirits of wine, 1 dr. linseed oil. Let stand till

dissolved, then add 3 oz. linseed oil. Apply with a piece of cheese cloth and rub to a polish.

Paint for Boilers.—Use asphaltum varnish to paint the metal work. There is little or no odor from it when dry. Another mixture is made of coal tar and ground graphite thinned with turpentine, which forms an excellent paint for boiler fronts and pipes in the boiler room. The steam pipes for heating should not be painted or, if required, should only have a very thin coat of lampblack and linseed oil. Rub the boiler front over with a mixture of boiled oil and lampblack. The grease should be taken from the latter before mixing by placing it in a flower pot, the top and bottom sealed with clay, and subjected to a good heat.

White Paint for Metallic Surfaces.—Oil paints used on metallic surfaces such as radiators, register facings, etc., exposed to heat frequently turn yellow. If instead of oil, sodium silicate be used, no change of color will be noticed. Zinc white mixed with soluble glass of from 40° to 50° B., to the consistency of ordinary paint, makes an excellent paint for metal.

INDEX

A

	PAGE
Accessories for Workbench	26
Acid Cup, Non-Spilling...	48
Adhesive Material	150
Adhesives, Marine Glue..	148
Adjusters, Drop Light....	140
Alarm Clock, Electrical...	127
Alarm, Overflow	125
Alarms, Fire	129
Alum and Plaster of Paris Cement	150
Angles, Laying out with two-foot rule	44
Annunciator, Simple	126
Appliances for Kitchen, Useful	78
Attachment Plugs, Simple	136
Automatic Draft Opening.	73

B

Batteries, Dry Cell.....	118
Batteries, Simple	116
Bell Construction, Electric	120
Bell Installation, Domestic	123
Bell, Single Stroke.....	121
Bell, Vibrating	121
Bell Wiring Diagrams....	122
Bench Furniture, Simple..	19
Bill of Materials, Magazine Rack	105
Bill of Materials, Tool Cabinet	110
Bill of Materials, Work- bench	14
Bits, Wood-Boring, Repair- ing	59
Black Lacquer for Metal or Wood	144
Blow Torch, Homemade..	48
Boiler, Paint for	154
Bolt, Expanding	57
Bolt for Door, Double....	70
Bracket, Metal Scaffold...	69

PAGE

Brass Polish	145
Brightening Silver Articles	146
Broom, Cleaning Dirt out of Corners	93
Broom, Combined with Ice- pick	93
Broom Hanger, Simple....	75
Brush, Cleaning Dirt out of Corners	93
Brush, Extension Handle for	64
Brush Handle Hook.....	63
Brush Handle, Keeping Clean	63

C

Cabinet for Wood-working Tools	108
Cabinet Scraper Handle...	52
Candle Lamp, Cheap....	102
Carrier, Package, for Bicy- cles	85
Cement for Iron	150
Cement for Pipe Joints..	149
Cement, Rubber	149
Cement to Mend Crockery	149
Cements and Adhesives..	148
Circuits, Bell Wiring....	122
Clamps for Workbench...	21
Cleaning Dirt out of Cor- ners	93
Cleaning Gloves	148
Cleaning Marble	147
Cleaning Paint	147
Cleaning Stove Pipes....	153
Cleaning Waste Pipes....	143
Clipping Trees	103
Clock, Electrical Alarm..	127
Closet for Kettles and Pans	99
Closet Hanger for Trou- sers	99

	PAGE		PAGE
Closet, Linen, Improving..	97	Electric Wires and Wiring	114
Clothes Hanger, Indoors..	97	Electrical Alarm Clock...	127
Combined Broom and Ice-pick	93	Electrical Fire Alarms ...	129
Compass, Substitute for..	49	Electrically Operated Door Locks	132
Controlling One Lamp from Two Points.....	138	Emergency Wrench for Pipe	55
Cooking Devices, Cost of Operating	132	Emptying Square Oil Can.	104
Cord Cutter, Efficient....	91	Equipment of Home Workshop	9
Corners, Metal, from Tubing	88	Expanding Bolt, Home-made	57
Cost of Operating Cooking Devices	132	Extension Handle for Brush	64
Cracked Ceilings, Filling for	145		
Crockery, Cement to Mend	149	F	
Curtain Pole, Installing...	100	Fastening Umbrella Handle	145
Cutting Sheet Metal	49	Filling Cracks in Floors.	145
		Filling for Cracked Ceilings	145
D		Filter, Efficient	80
Defective Fuses, Replacing	133	Fire Alarms, Simple....	129
Detector of Gas Leaks....	152	Floor Boards, Preventing Creaking	90
Domestic Call Bell Installation	123	Foot Pad for Ladders....	66
Door Locks, Electrically Operated	132	French Polish Reviver...	153
Door Opener for Furnace.	72	Frosting Glass	146
Door, Sagging	90	Furnace Door Opener....	72
Door Spring, Easily Made.	75	Furnace Door Stop.....	72
Door Stop, Economical....	76	Furniture, Simple Bench..	19
Door Stop for Furnace....	72	Fuses, Defective, Replacing	135
Double Bolt for Door....	70		
Doubling Capacity of Spring Balance.....	104	G	
Draft Opening, Automatic	73	Gas Leaks, Detector for..	152
Drain Pan, Locating....	91	Gas Meter, How to Read.	152
Drawer Details, Workbench	18	Gauge, Marking	52
Drill Gauge, Use of.....	57	Gauge, Sawing	58
Drop Light Adjusters....	140	Glass Holder, Drinking...	79
Dry Cell Batteries.....	118	Glass, To Frost.....	146
Dust Cloth, Oiled.....	151	Gloves, Cleaning	148
		Glue to Resist Damp....	149
E		Grease Spots, Removing..	147
Easy Rest for Feet.....	68		
Economical Door Stop....	76	H	
Electric Bell and Annunciator Wiring	112	Hacksaw, Thumb Rest for	51
Electric Bell Construction	120	Hacksaw, Wooden Frame.	51
Electric Flatiron for Stove	100	Hammer Handle, Repairing	54

	PAGE		PAGE
Hammer Handles, Wedging	53	Keeping Brush Handle Clean	63
Hammer, Soft-faced	53	Kettle Handle Support...	78
Hammers, Stunts with....	52	Kettles and Pans, Storing.	99
Hand Trucks, Useful....	84		
Handle for Cabinet Scraper	52	L	
Handle Hook for Brush..	63	Ladder Extension, Practical	68
Hanger for Broom.....	75	Ladder, Keeping from Slipping	66
Hanger for Clothes, Indoors	97	Ladder Step, Intermediate.	69
Hanger, Skirt or Pants..	75	Lamp for Candles, Cheap.	102
Hanger, : Trousers, for Closet	99	Lamp Guards and Shades..	27
Hanging Pictures, Pole for	88	Lamp, Night	139
Hardware for Home Workshop	43	Lamps for Fine Soldering	46
Heater for Soldering Iron	46	Leaky Faucet, Repairing..	82
Holder for Milk Bottle...	79	Leather Preservatives	151
Holding Small Screws....	55	Lighting the Workbench..	27
Home-made Blow Torch..	48	Linen Closet, Improving..	97
Home - made Expanding Bolt	57	Lock, One for Three Drawers	69
Home-made Night Lamp.	139	Locking Means, Secure ...	71
Home Water Works.....	80		
Home Workshop Equipment	9	M	
Home Workshop Location	10	Magazine Rack, Simple....	105
Home Workshop Supplies.	42	Magnetizing Shears	131
Hose Packing Washers...	82	Marble, Cleaning	147
Hose Reel, Home-made...	83	Marine Glue	148
Hose Repair, Garden....	82	Marking Gauge, Inexpensive	52
How to Read Gas Meter.	152	Metal Corners from Tubing	88
		Metal Scaffold Bracket....	69
I		Metal-Working Tools	35
Icepick, Combined with Broom	93	Metallic Surfaces, White Paints for	154
Improving Linen Closet..	97	Meter, How to Read.....	152
Indestructible Writing Ink	150	Milk Bottle Holder	79
Indoor Hanger for Clothes	97		
Ink Stains, Eradicating...	148	N	
Ink Stains, Removing from Wood	150	Nail Set, Stowing Away..	59
Iron Cement	149	Night Lamp, Home-made.	139
Ironing Board Support...	94	Non-spilling Acid Cup....	48
Installing Curtain Pole....	100		
Insulating Plier Handles..	57	O	
		Oil Can, Emptying	104
J		Oiled Dust Cloth	151
Joining Wires	124	One Lock for Three Drawers	69
		Overflow Alarm	125

P	PAGE
Package Carrier for Bicycles	85
Paint Brush Wiper, Simple	63
Paint, Cleaning	147
Paint for Boilers	154
Paint, White, for Metallic Surfaces	154
Pan Cover, Easily Made..	78
Paste for Labels	150
Picture Frame Hanging, Pole for	88
Pipe Cutting Wrench.....	61
Pipe Joints, Cement for...	149
Pipe Wrench, Simple.....	61
Plier Handles, Insulating..	57
Plugs, Attachment, Simple.	136
Pole for Hanging Pictures	88
Polish for Brass.....	145
Polish Reviver, French....	153
Polishing Stand for Shoes.	96
Preserving Leather	151
Pressing Board for Sleeves	94
Preventing Waste Water Splash	91
Push Button Construction.	113

R

Rack for Nails, etc.....	24
Racks for Tools	22
Raising Sagging Door	90
Range Boiler Repair	102
Reel for Hose, Home-made	83
Removing Grease Spots from Fabrics	147
Removing Ink Stains	148
Removing Ink Stains from Wood	150
Removing Rust from Steel	146
Removing Stud Bolts	58
Removing Wax from Cloth	147
Repairing Cracked Hammer Handle	54
Repairing Garden Hose...	82
Repairing Leaky Faucet..	82
Repairing Range Boiler...	102
Repairing Wood Boring Bits	59
Replacing Defective Fuses	133
Rotating Tool Rack.....	22
Rubber Cement	149
Rust, Removing from Steel	146

S

S	PAGE
Sagging Door, Raising ...	90
Sal-Ammoniac Battery, Care of	117
Saw Clamp, Simple	58
Sawhorse and Tool Carrier	29
Sawing Gauge, Extemporized	58
Screw Inserting Tool	60
Screws, Jaws for Holding	55
Secure Locking Means....	71
Selection of Shop Space..	10
Sharpening Skates, Kink for	55
Shears, Magnetizing	131
Sheet Metal, Cutting	49
Shoe Polishing Stand, Simple	96
Shop Space Selection.....	10
Silvering Metals	144
Simple Annunciator	126
Simple Batteries	117
Simple Bench Furniture..	19
Simple Magazine Rack....	105
Simple Pipe Wrench.....	61
Simple Saw Clamp	58
Simple Terminals	130
Single Stroke Bell	121
Skates, Kink for Sharpening	55
Skirt or Pants Hanger....	75
Sleeve Pressing Board	94
Soft-faced Hammer	53
Soldering Iron Heater	46
Soldering Iron, Keeping from Bench	60
Soldering Iron Kinks	60
Soldering Iron, Special Flat	60
Soldering, Lamps for Fine	46
Soot, Keeping in Stove Pipe	103
Spirit Lamps	46
Spoon, Keeping out of Kettle	80
Spring Balance, Doubling Capacity of	104
Spring for Door, Easily Made	75
Spring Tool Holder	22
Staples for Wiring	116
Stop for Door, Economical	76
Stop for Furnace Door...	72

	PAGE
Stove Pipes, Cleaning	153
Stowing Away Nail Set...	54
Stud Bolts, Removing	58
Stunts with Hammers	52
Suggestions for Home Painter	62
Supplies for Home Workshop	42
Support for Ironing Board	94

T

Terminals, Simple	130
Thumb Rest for Hacksaw.	51
Tool Cabinet, Working Drawings for	109
Tool Carrier and Sawhorse	29
Tool Chest and Equipment	30
Tool Holder, Spring	22
Tool Rack, Rotating	22
Tool, Screw Inserting....	60
Tools and Equipment for Shop	25
Tools, Metal Working ...	35
Tools, Woodworking	30
Tools, Woodworking, Cabinet for	108
Turning Pipe, Emergency Wrench	55

U

Umbrella Handle, Fastening	145
Useful Hand Trucks	84
Useful Kitchen Appliances	78
Using Partially Worn Zinc	131

V

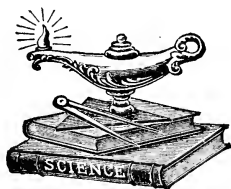
Vibrating Bell	121
----------------------	-----

W

	PAGE
Waste Pipes, Cleaning....	143
Waste Water, Preventing Splash	91
Water Filter, Easily Made	80
Wax, Removing from Cloth	147
Wedging Hammer Handles	53
White Paint for Metallic Surfaces	154
Whitewash, a Superior ...	143
Wiper, Paint Brush	63
Wires and Wiring, Electric	114
Wires, Joining	124
Wiring Diagrams, Bell ...	122
Wiring Dry Cells	119
Wiring, Staples for	116
Wood Boring Bits, Repairing	59
Wood Screws, Making Tight	90
Wooden Hacksaw Frame.	51
Woodworking Tools	30
Woodworking Tools, Cabinet for	108
Workbench Accessories ..	26
Workbench, Bill of Material	14
Workbench Construction .	13
Workbench, Details of Drawer	18
Workbench Lighting	27
Workbench, Working Drawings	12
Working Drawings for Magazine Rack	106
Working Drawings, Tool Cabinet	109
Working Drawings, Workbench	12
Wrench for Pipe Cutting.	61
Writing Ink, Indestructible	150
Writing on Steel	144

1920
REVISED
CATALOGUE
of LATEST and BEST

**Practical
and Mechanical Books**
Including Automobile and Aviation Books




PRACTICAL BOOKS FOR PRACTICAL MEN

Any of these books will be sent prepaid to any part of the world, on receipt of price. Remit by Draft, Postal Order, Express Order or Registered Letter.

Published and For Sale by
The Norman W. Henley Publishing Co.
2 West 45th Street New York, U. S. A.

INDEX TO SUBJECTS

Accidents	27	Locomotive Engineering,	
Air Brake	25, 26	24, 25, 26, 27	
Arithmetic	15, 29, 38	Machine Shop Practice,	
Automobiles	3, 4, 5, 6, 7	27, 29, 30, 31	
Automobile Charts	7	Manual Training	32
Aviation	8	Marine Engineering ...	32
Batteries	18	Mechanical Magazine ..	28
Bevel Gears	22	Mechanical Movements.	30
Brazing and Soldering.	9	Metal Turning	23
Cams	22	Metal Work Dies	13, 14
Charts	7, 8, 9	Mining	33
Chemistry	21	Motor Cycles	6, 7
Civil Engineering	29	Patents and Inventions.	23
Coke	10	Pattern Making	33
Compressed Air	10	Perfumery	34
Concrete	10, 11, 12, 13	Plumbing	34
Cosmetics	34	Receipt Book	35, 40
Dictionaries	14	Refrigeration and Ice..	22
Dies—Metal Work ..	13, 14	Repairing Automobiles..	6
Drawing—Sketching		Rubber	36
Paper	14, 15	Saws	36
Electric Bells	16	Screw Cutting	36
Electricity..	15, 16, 17, 18, 19	Sheet Metal Work ...	13, 14
Encyclopedia	29	Smoke Prevention	20
Factory Management,		Soldering	9
etc.	19	Starting Systems	5
Ford Automobile	6	Steam Engineering..	36, 37, 38
Fuel	20	Steam Heating and Ven-	
Flying Machines	8	tilation	38
Gas Engines and Gas,		Steel	38, 39
20, 21, 22		Storage Batteries	18
Gearing and Cams	22	Switch Boards	17, 19
Hydraulics	22	Tractor	22, 39
Ice and Refrigeration..	22	Turbines	39
Inventions—Patents ...	23	Ventilation	38
Knots	23	Waterproofing	13
Lathe Work	23, 24	Welding	5
Link Motion	25	Wiring	17, 18
Liquid Air	24	Wireless Telephones ..	19

 Any of these books will be sent prepaid to any part of the world, on receipt of price.

REMIT by Draft, Postal Money Order, Express Money Order, or by Registered Mail.

GOOD, USEFUL BOOKS

AUTOMOBILES—MOTORCYCLES

The Modern Gasoline Automobile, Its Design, Construction, Operation.

By VICTOR W. PAGÉ, M.S.A.E. This is the most complete, practical, and up-to-date treatise on gasoline automobiles and their component parts ever published. In the new revised and enlarged 1920 edition, all phases of automobile construction, operation and maintenance are fully and completely described and in language anyone can understand. Every part of all types of automobiles, from light cyclecars to heavy motor trucks and tractors, are described in a thorough manner; not only the automobile, but every item of its equipment, accessories, tools needed, supplies and spare parts necessary for its upkeep, are fully discussed. It is clearly and concisely written by an expert familiar with every branch of the automobile industry and the originator of the practical system of self-education on technical subjects; it is a liberal education in the automobile art, useful to all who motor for either business or pleasure. Anyone reading the incomparable treatise is in touch with all improvements that have been made in motor car construction. All latest developments, such as high speed aluminum motors and multiple valve and sleeve valve engines, are considered in detail. The latest ignition, carburetor and lubrication practice is outlined. New forms of change speed gears, and final power transmission systems, and all latest chassis improvements, are shown and described. This book is used as a text in all leading automobile schools, and is conceded to be the standard treatise. The chapter on Starting and Lighting Systems has been greatly enlarged, and many automobile engineering features that have long puzzled laymen are explained so clearly that the underlying principles can be understood by anyone. This book was first published six years ago, and so much new matter has been added to the book that it is nearly twice its original size. The only treatise covering various forms of war automobiles and recent developments in motor truck design, as well as pleasure cars. This book is not too technical for the layman nor too elementary for the more expert. It is an incomparable work of reference for home or school. 6 x 9. Cloth, 1,000 pages, nearly 1,000 illustrations, 12 folding plates.

Price, \$4.00

Questions and Answers Relating to Modern Automobile Construction, Driving and Repair.

By VICTOR W. PAGÉ. A self-educator on automobiling without an equal. This practical treatise consists of a series of thirty-seven lessons, covering with over 2,000 questions and their answers—the automobile, its construction, operation and repair. The subject matter is absolutely correct and explained in simple language. If you can't answer all of the following questions, you need this work. The answers to these and 2,000 more are to be found in its pages.

Give the name of all important parts of an automobile and describe their functions. Describe action of latest types of kerosene carburetors. What is the difference between a "double" ignition system and a "dual" ignition system? Name parts of an induction coil. How are valves timed? What is an electric motor starter and how does it work? What are advantages of worm drive gearing? Name all important types of ball and roller bearings. What is a "three-quarter" floating axle? What is a two-speed axle? What is the Vulcan electric gear shift? Name the causes of lost power in automobiles. Describe all noises due to deranged mechanism and give causes. How can you adjust a carburetor by the color of the exhaust gases? What causes "popping" in the carburetor? What tools and supplies are needed to equip a car? How do you drive various makes of cars? What is a differential lock and where is it used? Name different systems of wire wheel construction. What is a "positive" drive differential? etc., etc. Answers every question asked relating to the modern automobile. A popular work at a popular price. $5\frac{1}{4} \times 7\frac{1}{2}$. Cloth, 650 pages, 392 illustrations, 3 folding plates. 1920 Edition just published.

Price, \$2.50

How to Run an Automobile.

By VICTOR W. PAGÉ. This treatise gives concise instructions for starting and running all makes of gasoline automobiles, how to care for them, and gives distinctive features of control. Describes every step for shifting gears, controlling engine, etc. Among the chapters contained are: I. Automobile Parts and Their Functions. II. General Starting and Driving Instructions. III. Typical 1919 Control Systems—Care of Automobiles. Thoroughly illustrated. 178 pages, 72 illustrations.

Price, \$1.50

The Automobileist's Pocket Companion and Expense Record.

By VICTOR W. PAGÉ. This book is not only valuable as a convenient cost record, but contains much information of value to motorists. Includes a condensed digest of auto laws of all States, a lubrication schedule, hints for care of storage battery and care of tires, location of road troubles, anti-freezing solutions, horsepower table, driving hints and many useful tables and recipes of interest to all motorists. Not a technical book in any sense of the word, just a collection of practical facts in simple language for the everyday motorist. Convenient pocket size.

Price, \$1.25

Gasoline and Kerosene Carburetors, Construction, Installation and Adjustment.

By CAPT. V. W. PAGÉ. All leading types of carburetors are described in detail, special attention being given to the forms devised to use the cheaper fuels such as kerosene. Carburetion troubles, fuel system troubles, carburetor repairs and installation, electric primers and economizers, hot spot manifolds and all modern carburetor developments are considered in a thorough manner. Methods of adjusting all types of carburetors are fully discussed as well as suggestions for securing maximum fuel economy and obtaining highest engine power. 250 pages, 89 illustrations. **Price, \$2.00**

Starting, Lighting and Ignition Systems.

By VICTOR W. PAGÉ. A practical treatise on latest automobile starting, lighting and ignition system practice. This practical volume has been written with special reference to the requirements of the reader desiring easily understood explanatory matter relating to all types of automobile electrical systems. It can be understood by anyone, even without electrical knowledge, because elementary electrical principles are considered before any attempt is made to discuss features of the various systems. These basic principles are clearly stated and illustrated with simple diagrams. All the leading systems of starting, lighting and ignition have been described and illustrated with the cooperation of the experts employed by the manufacturers. Over 200 wiring diagrams are shown in both technical and nontechnical forms. Complete data is given for locating troubles in all systems, the various steps being considered in a logical way for those without expert electrical knowledge. All ignition systems receive full consideration, starting with the simplest battery and coil forms found on early cars to the modern short-contact timer and magneto methods used with the latest eight and twelve-cylinder motors. Full directions are given for making all repairs and complete instructions for locating troubles with meters. This book is unusually complete, as it also includes descriptions of various accessories operated by electric current, such as electrical gear shifts, brake actuation, signaling devices, vulcanizers, etc. Over 700 pages. 425 specially made engravings. 1920 Edition, Revised and Enlarged. **Price, \$3.00**

Automobile Welding with the Oxy-Acetylene Flame.

By M. KEITH DUNHAM. Explains in a simple manner apparatus to be used, its care, and how to construct necessary shop equipment. Proceeds then to the actual welding of all automobile parts, in a manner understandable by everyone. *Gives principles never to be forgotten.* This book is of utmost value, since the perplexing problems arising when metal is heated to a melting point are fully explained and the proper methods to overcome them shown. 167 pages, fully illustrated. **Price, \$1.50**

Automobile Repairing Made Easy.

By VICTOR W. PAGÉ. A thoroughly practical book containing complete directions for making repairs to all parts of the motor car mechanism. Written in a thorough but non-technical manner. Gives plans for workshop construction, suggestions for equipment, power needed, machinery and tools necessary to carry on business successfully. Tells how to overhaul and repair all parts of all automobiles. The information given is founded on practical experience, everything is explained so simply that motorists and students can acquire a full working knowledge of automobile repairing. Other works dealing with repairing cover only certain parts of the car—this work starts with the engine, then considers carburetion, ignition, cooling and lubrication systems. The clutch, change speed gearing and transmission system are considered in detail. Contains instructions for repairing all types of axles, steering gears and other chassis parts. Many tables, short cuts in figuring and rules of practice are given for the mechanic. Explains fully valve and magneto timing, "tuning" engines, systematic location of trouble, repair of ball and roller bearing, shop kinks, first aid to injured and a multitude of subjects of interest to all in the garage and repair business. All illustrations are especially made for this book, and are actual photographs or reproductions of engineering drawings. This book also contains Special Instructions on Electric Starting, Lighting and Ignition Systems, Tire Repairing and Rebuilding, Autogenous Welding, Brazing and Soldering, Heat Treatment of Steel, Latest Timing Practice, Eight and Twelve-Cylinder Motors, etc., etc. You will never "Get Stuck" on a Job if you own this book. 1,000 specially made engravings on 500 plates. 1,056 pages (5½ x 8). 1920 Edition. **Price, \$4.00**

The Model T Ford Car, Its Construction, Operation and Repair, Including the Fordson Farm Tractor, F. A. Lighting and Starting System, Ford Motor Truck.

By VICTOR W. PAGÉ. This is the most complete and practical instruction book ever published on the Ford car and Fordson tractor. A high grade, cloth bound book, printed on the best paper, illustrated by specially made drawings and photographs. All parts of the Ford Model T car and Fordson tractor are described and illustrated in a comprehensive manner. The construction is fully treated and operating principle made clear to everyone. Complete instructions for driving and repairing are given. To the 1920 Revised Edition matter has been added on the Ford Truck and Tractor Conversion Sets and Genuine Fordson Tractor. All parts are described. All repair processes illustrated and fully explained. Written so all can understand—no theory, no guesswork. New Edition. 153 illustrations, 410 pages, 2 large folding plates. **Price, \$2.00**

Motorcycles, Side Cars and Cyclecars, Their Construction, Management and Repair.

By VICTOR W. PAGÉ. Describes fully all leading types of machines, their design, construction, maintenance, operation and repair. 550 pages. 350 specially made illustrations, 5 folding plates. New Edition. **Price, \$2.50**

Automobile Charts

By VICTOR W. PAGE, M.S.A.E.

THE POPULAR AUTOMOBILE SERIES
UNIFORM SIZE—24" x 38"—PRICE 35 CENTS EACH

Location of Gasoline Engine Troubles Made Easy.

This chart shows clearly all parts of a typical four-cylinder gasoline engine of the four-cycle type. It simplifies location of all engine troubles. No details omitted.

Price, 35 cents

Location of Carburetion Troubles Made Easy.

It shows clearly how to find carburetion troubles and names all defects liable to exist in the various parts. Instructions are given for carburetor adjustment.

Price, 35 cents.

Location of Ignition System Troubles Made Easy.

In this chart all parts of a typical double ignition system using battery and magneto current are shown, and suggestions are given for readily finding ignition troubles and eliminating them when found.

Price, 35 cents

Location of Cooling and Lubricating Troubles.

This is a combination chart showing all components of the approved form of water cooling group as well as a modern engine lubrication system. It shows all points where defects exist that may result in engine overheating, both in cooling and oiling systems.

Price, 35 cents

Lubrication of the Motor Car Chassis.

This chart presents the plan view of a typical six-cylinder chassis of standard design and outlines all important bearing points requiring lubrication, and is a valuable guide to the correct lubrication of any modern car. A practical chart for all interested in motor car maintenance.

Price, 35 cents.

While each chart is complete in itself, the set covers all maintenance instructions for the entire automobile. Sold singly. Securely wrapped.

Location of Starting and Lighting System Faults.

The most complete chart yet devised, showing all parts of the modern automobile starting, lighting and ignition systems, giving instructions for systematic location of all faults in wiring, lamps, motor or generator, switches and all other units. Invaluable to motorists, chauffeurs and repairmen. Size 24 x 38 inches

Price, 35 cents

Location of Ford Engine Troubles Made Easy.

Chart showing clear sectional views depicting all portions of the Ford power plant and auxiliary groups. It outlines clearly all parts of the engine, fuel supply systems, ignition group and cooling system, that are apt to give trouble, detailing all derangements that are liable to make an engine lose power, start hard, or work irregularly. This chart simplifies location of all engine faults. Size 25 x 38 inches.

Price, 35 cents

Location of Motorcycle Troubles Made Easy.

This chart simplifies location of all power-plant troubles and will prove of value to all who have to do with the operation, repair or sale of motorcycles. No details omitted. Size 30 x 20 inches.

Price, 35 cents

AVIATION

A B C of Aviation.

By CAPT. V. W. PAGÉ. This book describes the basic principles of aviation, tells how a balloon or dirigible is made and why it floats in the air. Describes how an airplane flies. It shows in detail the different parts of an airplane, what they are and what they do. Describes all types of airplanes and how they differ in construction; as well as detailing the advantages and disadvantages of different types of aircraft. It includes a complete dictionary of aviation terms and clear drawings of leading airplanes. The reader will find simple instructions for unpacking, setting up and rigging airplanes. A full description of airplane control principles is given and methods of flying are discussed at length.

This Book answers every question one can ask about modern aircraft, their construction and operation. A self education on aviation without an equal. 275 pages, 130 specially made illustrations with 7 plates. **Price, \$2.50**

Aviation Engines—Design; Construction; Repair.

By LIEUT. VICTOR W. PAGÉ, Aviation Section, S.C.U.S.R. This treatise, written by a recognized authority on all of the practical aspects of internal combustion engine construction, maintenance and repair, fills the need as no other book does. The matter is logically arranged; all descriptive matter is simply expressed and copiously illustrated, so that anyone can understand airplane engine operation and repair even if without previous mechanical training. This work is invaluable for anyone desiring to become an aviator or aviation mechanic.

The latest rotary types, such as the Gnome Monosoupape, and LeRhône, are fully explained, as well as the recently developed Vee and radial types. The subjects of carburetion, ignition, cooling and lubrication also are covered in a thorough manner. The chapters on repair and maintenance are distinctive and found in no other book on this subject. Not a technical book, but a practical, easily understood work of reference for all interested in aeronautical science. 576 pages, 253 illustrations. **Price, Net, \$3.00**

Glossary of Aviation Terms—English-French; French-English.

A complete glossary of practically all terms used in aviation, having lists in both French and English with equivalents in either language compiled by LIEUTS. VICTOR W. PAGÉ, A.S., S.C.U.S.R., and PAUL MONTARIOL, of the French Flying Corps. **Price, Net, \$1.00**

Aviation Chart—Location of Airplane Power Plant Troubles Made Easy.

By LIEUT. VICTOR W. PAGÉ, A.S., S.C.U.S.R. A large chart outlining all parts of a typical airplane power plant, showing the points where trouble is apt to occur and suggesting remedies for the common defects. Intended especially for aviators and aviation mechanics on school and field duty. **Price. 35 cents**

BRAZING AND SOLDERING

Brazing and Soldering.

By JAMES F. HOBART. The only book that shows you just how to handle any job of brazing or soldering that comes along; it tells you what mixture to use, how to make a furnace if you need one. Full of valuable kinks. The fifth edition of this book has just been published, and to it much new matter and a large number of tested formulas for all kinds of solders and fluxes have been added. **Price, 35c.**

CHARTS

Aviation Chart—Location of Airplane Power Plant Troubles Made Easy.

By LIEUT. VICTOR W. PAGÉ, A.S., S.C.U.S.R. A large chart outlining all parts of a typical airplane power plant, showing the points where trouble is apt to occur and suggesting remedies for the common defects. Intended especially for aviators and aviation mechanics on school and field duty.

Price, 35 cents

Modern Submarine Chart—With 200 Parts Numbered and Named.

A cross-section view, showing clearly and distinctly all the interior of a submarine of the latest type. No details omitted—everything is accurate and to scale. This chart is really an encyclopedia of a submarine.

Price, 25 cents

Box Car Chart.

A chart showing the anatomy of a box car, having every part of the car numbered and its proper name given in a reference list.

Price, 25 cents

Gondola Car Chart.

A chart showing the anatomy of a gondola car, having every part of the car numbered and its proper reference name given in a reference list.

Price, 25 cents

Passenger Car Chart.

A chart showing the anatomy of a passenger car, having every part of the car numbered and its proper name given in a reference list.

Price, 25 cents

Steel Hopper Bottom Coal Car.

A chart showing the anatomy of a steel hopper bottom coal car, having every part of the car numbered and its proper name given in a reference list.

Price, 25 cents

Tractive Power Chart.

A chart whereby you can find the tractive power or drawbar pull of any locomotive without making a figure. Shows what cylinders are equal, how driving wheels and steam pressure affect the power. What sized engine you need to exert a given drawbar pull or anything you desire in this line.

Price, 50 cents

Horse-power Chart.

Shows the horse-power of any stationary engine without calculation. No matter what the cylinder diameter of stroke, the steam pressure or cut-off, the revolutions, or whether condensing or non-condensing, it's all there. Easy to use, accurate and saves time and calculations. Especially useful to engineers and designers.

Price, 50 cents

Boiler Room Chart.

By GEORGE L. FOWLER. A chart—size 14 x 28 inches—showing in isometric perspective the mechanisms belonging in a modern boiler room. This chart is really a dictionary of the boiler room—the names of more than 200 parts being given.

Price, 25 cents

COKE

Coke—Modern Coking Practice, Including Analysis of Materials and Products.

By J. E. CHRISTOPHER and T. H. BYROM. This, the standard work on the subject, has just been revised and is now issued in two volumes. It is a practical work for those engaged in Coke manufacture and the recovery of By-products. Fully illustrated with folding plates. It has been the aim of the authors, in preparing this book, to produce one which shall be of use and benefit to those who are associated with, or interested in, the modern developments of the industry. Among the chapters contained in Volume I are: Introduction; Classification of Fuels; Impurities of Coals; Coal Washing; Sampling and Valuation of Coals, etc.; Chlorific Power of Fuels; History of Coke Manufacture; Developments in Coke Oven Design; Recent Types of Coke Ovens; Mechanical Appliances at Coke Ovens; Chemical and Physical Examination of Coke. Volume II covers By-products. Each volume is fully illustrated, with folding plates.

Price, \$3.00 per volume

COMPRESSED AIR

Compressed Air in all Its Applications.

By GARDNER D. HISCOX. This is the most complete book on the subject of air that has ever been issued, and its thirty-five chapters include about every phase of the subject one can think of. It may be called an encyclopedia of compressed air. It is written by an expert, who, in its 665 pages, has dealt with the subject in a comprehensive manner, no phase of it being omitted. Over 500 illustrations. Fifth Edition, revised and enlarged. Cloth bound, \$6.00. Half Morocco, revised and enlarged. Cloth bound.

Price, \$6.00

CONCRETE

Concrete Wall Forms.

By A. A. HOUGHTON. A new automatic wall clamp, is illustrated with working drawings. Other types of wall forms, clamps, separators, etc., are also illustrated and explained.

Price, 75 cents

Concrete Floors and Sidewalks.

By A. A. HOUGHTON. The molds for molding squares, hexagonal and many other styles of mosaic floor and sidewalk blocks are fully illustrated and explained. **Price, 75 cents**

Practical Concrete Silo Construction.

By A. A. HOUGHTON. Complete working drawings and specifications are given for several styles of concrete silos, with illustrations of molds for monolithic and block silos. The tables, data, and information presented in this book are of the utmost value in planning and constructing all forms of concrete silos. **Price, 75 cents**

Molding Concrete Bath Tubs, Aquariums and Natatoriums.

By A. A. HOUGHTON. Simple molds and instruction are given for molding different styles of concrete bath tubs, swimming pools, etc. **Price, 75 cents**

Molding Concrete Chimneys, Slate and Roof Tiles.

By A. A. HOUGHTON. The manufacture of all types of concrete slate and roof tile is fully treated. Valuable data on all forms of reinforced concrete roofs are contained within its pages. The construction of concrete chimneys by block and monolithic systems is fully illustrated and described. A number of ornamental designs of chimney construction with molds are shown in this valuable treatise. **75 cents**

Molding and Curing Ornamental Concrete.

By A. A. HOUGHTON. The proper proportions of cement and aggregates for various finishes, also the methods of thoroughly mixing and placing in the molds, are fully treated. An exhaustive treatise on this subject that every concrete worker will find of daily use and value. **Price, 75 cents**

Concrete Monuments, Mausoleums and Burial Vaults.

By A. A. HOUGHTON. The molding of concrete monuments to imitate the most expensive cut stone is explained in this treatise, with working drawings of easily built molds. Cutting inscriptions and designs is also fully treated. **75 cents**

Concrete Bridges, Culverts and Sewers.

By A. A. HOUGHTON. A number of ornamental concrete bridges with illustrations of molds are given. A collapsible center of core for bridges, culverts and sewers is fully illustrated with detailed instructions for building. **75 cents**

Constructing Concrete Porches.

By A. A. HOUGHTON. A number of designs with working drawings of molds are fully explained so any one can easily construct different styles of ornamental concrete porches without the purchase of expensive molds. **Price, 75 cents**

Molding Concrete Flower Pots, Boxes, Jardinieres, Etc.

By A. A. HOUGHTON. The molds for producing many original designs of flower pots, urns, flower boxes, jardinieres, etc., are fully illustrated and explained, so the worker can easily construct and operate same. **Price, 75 cents**

Molding Concrete Fountains and Lawn Ornaments.

By A. A. HOUGHTON. The molding of a number of designs of lawn seats, curbing, hitching posts, pergolas, sun dials and other forms of ornamental concrete, for the ornamentation of lawns and gardens, is fully illustrated and described. **75c.**

Concrete on the Farm and in the Shop.

By H. COLVIN CAMPBELL. This is a new book from cover to cover, illustrating and describing in plain, simple language many of the numerous appliances of concrete within the range of the home worker. Among the subjects treated are: Principles of reinforcing; methods of protecting concrete so as to insure proper hardening; home-made mixers; mixing by hand and machine; form construction, described and illustrated by drawings and photographs; construction of concrete walls and fences; concrete fence posts; concrete gate posts; corner posts; clothes line posts; grape arbor posts; tanks; troughs; cisterns; hog wallows; feeding floors and barnyard pavements; foundations; well curbs and platforms; indoor floors; sidewalks; steps; concrete hotbeds and cold frames; concrete slab roofs; walls for buildings; repairing leaks in tanks and cisterns; and all topics associated with these subjects as bearing upon securing the best results from concrete are dwelt upon at sufficient length in plain every-day English so that the inexperienced person desiring to undertake a piece of concrete construction can, by following the directions set forth in this book, secure 100 per cent success every time. A number of convenient and practical tables for estimating quantities, and some practical examples, are also given. 150 pages, 51 illustrations. **Price, \$1.00**

Concrete From Sand Molds.

By A. A. HOUGHTON. A practical work treating on a process which has heretofore been held as a trade secret by the few who possessed it, and which will successfully mold every and any class of ornamental concrete work. The process of molding concrete with sand molds is of the utmost practical value, possessing the manifold advantages of a low cost of molds, the ease and rapidity of operation, perfect details to all ornamental designs, density and increased strength of the concrete, perfect curing of the work without attention and the easy removal of the molds regardless of any undercutting the design may have. 192 pages. Fully illustrated. Cloth. **Price, \$2.00**

Ornamental Concrete Without Molds.

By A. A. HOUGHTON. The process for making ornamental concrete without molds has long been held as a secret, and now, for the first time, this process is given to the public. The book reveals the secret and is the only book published

which explains a simple, practical method whereby the concrete worker is enabled, by employing wood and metal templates of different designs, to mold or model in concrete any cornice, archivolt, column, pedestal, base cap, urn or pier in a monolithic form—right upon the job. These may be molded in units or blocks, and then built up to suit the specifications demanded. This work is fully illustrated, with detailed engravings. Cloth. **Price, \$2.00**

Popular Handbook for Cement and Concrete Users.

By MYRON H. LEWIS. Everything of value to the concrete user is contained, including kinds of cement employed in construction, concrete architecture, inspection and testing, waterproofing, coloring and painting, rules tables, working and cost data. The book comprises thirty-three chapters. A valuable addition to the library of every cement and concrete user. Cloth, 430 pages, 126 illustrations. **Price, \$3.00**

Waterproofing Concrete.

By MYRON H. LEWIS. Modern methods of waterproofing concrete and other structures. A condensed statement of the principles, rules and precautions to be observed in waterproofing and damp-proofing structures and structural materials. Paper binding. Illustrated. Second Edition. **75 cents**

DIES—METAL WORK

Dies; Their Construction and Use for the Modern Working of Sheet Metals.

By J. V. WOODWORTH. A new book by a practical man, for those who wish to know the latest practice in the working of sheet metals. It shows how dies are designed, made and used, and those who are engaged in this line of work can secure many valuable suggestions. Sixth revised edition. 525 illustrations, 394 pages. Cloth. **Price, \$3.50**

Punches, Dies and Tools for Manufacturing in Presses.

By J. V. WOODWORTH. An encyclopedia of die-making, punch-making, die-sinking, sheet-metal working, and making of special tools, subpresses, devices and mechanical combinations for punching, cutting, bending, forming, piercing, drawing, compressing, and assembling sheet-metal parts and also articles of other materials in machine tools. This is a distinct work from the author's book entitled "Dies; Their Construction and Use." 500 pages, 700 engravings. Second edition. Cloth. **Price, \$4.50**

Drop Forging, Die-Sinking and Machine-Forming of Steel.

By J. V. WOODWORTH. The processes of die-sinking and force-making, which are thoroughly described and illustrated in this admirable work, are rarely to be found explained in such a clear and concise manner as is here set forth. The process of die-sinking relates to the engraving or sinking

of the female or lower dies, such as are used for drop forgings, hot and cold machine forging, swedging and the press working of metals. The process of force-making relates to the engraving or raising of the male or upper dies used in producing the lower dies for the press-forming and machine-forging of duplicate parts of metal. The book contains eleven chapters, and the information contained in these chapters is just what will prove most valuable to the forged-metal worker. 304 detailed illustrations. 341 pages, cloth.

Price, \$3.00

DICTIONARIES

Aviation Terms—English-French; French-English.

A complete glossary of practically all terms used in aviation, having lists in both French and English with equivalents in either language. A very valuable book compiled by Lieuts. Victor W. Pagé and Paul Montariol.

Price, \$1.00

Standard Electrical Dictionary.

By PROF. T. O'CONOR SLOANE. Just issued an entirely new edition brought up to date and greatly enlarged—as a reference book this work is beyond comparison as it contains over 700 pages, nearly 500 illustrations, and definitions of about 6,000 distinct words, terms and phrases. The definitions are terse and concise and includes every term used in electrical science.

In its arrangement and typography the book is very convenient. The word or term defined is printed in black faced type which readily catches the eye, while the body of the page is in smaller but distinct type. The definitions are well worded, and so as to be understood by the non-technical reader. The general plan is to give an exact, concise definition, and then amplify and explain in a more popular way. Synonyms are also given, and references to other words and phrases are made. This work is absolutely indispensable to all in any way interested in electrical science, from the higher electrical expert to the everyday electrical workman. In fact, it should be in the possession of all who desire to keep abreast with the progress of this branch of science. 1920 enlarged edition. Nearly 800 pages and nearly 400 illustrations.

Price, \$5.00

DRAWING—SKETCHING PAPER

Linear Perspective Self-Taught.

By HERMAN T. C. KRAUS. This work gives the theory and practice of linear perspective, as used in architectural, engineering and mechanical drawings. The arrangement of the book is good; the plate is on the left-hand, while the descriptive text follows on the opposite page, so as to be readily referred to. A self-explanatory linear perspective chart is included in the second revised edition. Cloth.

Price, \$3.00

Self-Taught Mechanical Drawing and Elementary Machine Design.

By F. L. SYLVESTER, M.E., Draftsman, with additions by Erik Oberg, associate editor of "Machinery." A practical elementary treatise on Mechanical Drawing and Machine Design, comprising the first principles of geometric and mechanical drawing, workshop mathematics, mechanics, strength of materials and the calculation and design of machine details, compiled for the use of practical mechanics and young draftsmen. 330 pages, 215 engravings, cloth. **Price, \$2.50**

A New Sketching Paper.

A new specially ruled paper to enable you to make sketches or drawings in isometric perspective without any figuring or fussing. It is being used for shop details as well as for assembly drawings, as it makes one sketch do the work of three, and no workman can help seeing just what is wanted. Pads of 40 sheets, 6 x 9 inches, **Price, 25c.**; 9 x 12 inches, **Price, 50c.**; 12 x 18 inches, **Price, \$1.00.**

Practical Perspective.

By RICHARDS and COLVIN. Shows just how to make all kinds of mechanical drawings in the only practical perspective isometric. Makes everything plain so that any mechanic can understand a sketch or drawing in this way. Saves time in the drawing room and mistakes in the shops. Contains practical examples of various classes of work. Third edition. Limp cloth. **Price, 75 cents**

ELECTRICITY

Arithmetic of Electricity.

By PROF. T. O'CONOR SLOANE. A practical treatise on electrical calculations of all kinds reduced to a series of rules, all of the simplest forms, and involving only ordinary arithmetic; each rule illustrated by one or more practical problems with detailed solution of each one. This book is classed among the most useful works published on the science of electricity, covering as it does the mathematics of electricity in a manner that will attract the attention of those who are not familiar with algebraical formulas. 200 pages. 1920 Revised and Enlarged edition. **Price, \$1.50**

Dynamo Building for Amateurs, or How to Construct a Fifty Watt Dynamo.

By ARTHUR J. WEED. A practical treatise showing in detail the construction of a small dynamo or motor, the entire machine work of which can be done on a small foot lathe. Dimensioned working drawings are given for each piece of machine work, and each operation is clearly described. This machine, when used as a dynamo, has an output of fifty watts; when used as a motor it will drive a small drill press or lathe. It can be used to drive a sewing machine on any and all ordinary work. The book is illustrated with more than sixty original engravings showing the actual construction of the different parts. **Price, Cloth, \$1.00**

Electric Bells.

By M. B. SLEEPER. A complete treatise for the practical worker in installing, operating and testing bell circuits, burglar alarms, thermostats and other apparatus used with electric bells. Both the electrician and the experimenter will find in this book new material which is essential in their work. Tools, bells, batteries, unusual circuits, burglar alarms, annunciators, systems, thermostats, circuit breakers, time alarms, and other apparatus used in bell circuits are described from the standpoints of their application, construction, and repair. The detailed instructions for building the apparatus will appeal to the experimenter particularly. The practical worker will find the chapters on Wiring Calculation of Wire Sizes and Magnet Windings, Upkeep of Systems and the Location of Faults of the greatest value in their work. 124 pages. Fully illustrated. **Price, 75 cents.**

Commutator Construction

By WM. BAXTER, JR. The business end of dynamo or motor of the direct current type is the commutator. This book goes into the designing, building and maintenance of commutators, shows how to locate troubles and how to remedy them; everyone who fusses with dynamos needs this. Fourth edition. **Price, 35 cents.**

Dynamos and Electric Motors and All About Them.

By EDWARD TREVERT. This volume gives practical directions for building a two H. P. Dynamo of the Edison type capable of lighting about fifty mazda lamps of the 20 watt size. In addition, it gives directions for building two small electric motors suitable for running sewing machines. The concluding chapter describes the construction of a simple bichromate battery adapted for running electric motors. 96 pages. Fully illustrated with detail drawings. Cloth. **Price, \$1.00.**

Construction of a Transatlantic Wireless Receiving Set.

By L. G. PACENT and T. S. CURTIS. A work for the Radio student who desires to construct and operate apparatus that will permit of the reception of messages from the large stations in Europe with an aerial of amateur proportions. 36 pages. 23 illustrations, cloth. **Price, 35 cents.**

Electric Toy Making, Dynamo Building and Electric Motor Construction.

This work treats of the making at home of electrical toys, electrical apparatus, motors, dynamos and instruments in general and is designed to bring within the reach of young and old the manufacture of genuine and useful electrical appliances. 210 pages, cloth. Fully illustrated. Twentieth edition, enlarged. **Price, \$1.50**

Experimental High Frequency Apparatus, How to Make and Use It.

By THOMAS STANLEY CURTIS. 69 pages, illustrated. **Price, 50 cents.**

Electrician's Handy Book.

By PROF. T. O'CONOR SLOANE. This work has just been revised and much enlarged. It is intended for the practical electrician who has to make things go. The entire field of electricity is covered within its pages. It is a work of the most modern practice, written in a clear, comprehensive manner, and covers the subject thoroughly, beginning at the A B C of the subject, and gradually takes you to the more advanced branches of the science. It teaches you just what you should know about electricity. A practical work for the practical man. Contains forty-eight chapters.

The publishers consider themselves fortunate in having secured the services of such a well and favorably known writer as Prof. Sloane, who has with the greatest care completed a master work in concise form on this all important subject. 600 engravings, 840 pages, handsomely bound in cloth. 1920 Edition.

Price, \$4.00

Electricity Simplified.

By PROF. T. O'CONOR SLOANE. The object of 'Electricity Simplified' is to make the subject as plain as possible and to show what the modern conception of electricity is; to show how two plates of different metals immersed in acid can send a message around the globe; to explain how a bundle of copper wire rotated by a steam engine can be the agent in lighting our streets, to tell what the volt, ohm and ampere are, and what high and low tension mean; and to answer the questions that perpetually arise in the mind in this age of electricity. 172 pages. Illustrated. Thirteenth edition. Cloth.

Price, \$1.50

Electric Wiring, Diagrams and Switchboards.

By NEWTON HARRISON, with additions by THOMAS POPPE. This is the only complete work issued showing and telling you what you should know about direct and alternating current wiring. The work is free from advanced technicalities and mathematics, arithmetic being used throughout. It is in every respect a handy, well-written, instructive, comprehensive volume on wiring for the wireman, foreman, contractor or electrician. Third revised edition. 303 pages, 130 illustrations. Cloth.

Price, \$2.50

House Wiring.

By THOMAS W. POPPE. Describing and illustrating up-to-date methods of installing electric light wiring. Contains just the information needed for successful wiring of a building. Fully illustrated with diagrams and plans. It solves all wiring problems and contains nothing that conflicts with the rulings of the National Board of Fire Underwriters. Third edition revised and enlarged. 125 pages, fully illustrated, flexible cloth.

Price, 75 cents

High Frequency Apparatus, Its Construction and Practical Application.

By THOMAS STANLEY CURTIS. The most comprehensive and thorough work on this interesting subject ever produced. The book is essentially practical in its treatment and it constitutes an accurate record of the researches of its author over a period of several years, during which time dozens of coils were built and experimented with. New revised and enlarged 1920 edition. 275 pages.

Price, \$3.00

How to Become a Successful Electrician.

By PROF. T. O'CONOR SLOANE. An interesting book from cover to cover. Telling in simplest language the surest and easiest way to become a successful electrician. The studies to be followed, methods of work, field of operation and the requirements of the successful electrician are pointed out and fully explained. 202 pages. Illustrated. Eighteenth revised edition. Cloth.

Price, \$1.50

Standard Electrical Dictionary.

By PROF. T. O'CONOR SLOANE. Just issued an entirely new edition brought up to date and greatly enlarged—as a reference book this work is beyond comparison as it contains over 700 pages, nearly 500 illustrations, and definitions of about 6,000 distinct words, terms and phrases. The definitions are terse and concise and includes every term used in electrical science.

In its arrangement and typography the book is very convenient. The word or term defined is printed in black faced type which readily catches the eye, while the body of the page is in smaller but distinct type. The definitions are well worded, and so as to be understood by the non-technical reader. The general plan is to give an exact, concise definition, and then amplify and explain in a more popular way. Synonyms are also given, and references to other words and phrases are made. This work is absolutely indispensable to all in any way interested in electrical science, from the higher electrical expert to the everyday electrical workman. In fact, it should be in the possession of all who desire to keep abreast with the progress of this branch of science. 1920 enlarged edition. Nearly 800 pages. 400 illustrations.

Price, \$5.00

Storage Batteries Simplified.

By VICTOR W. PAGÉ, M.S.A.E. This is the most thorough and authoritative treatise ever published on this subject. It is written in easily understandable, non-technical language so that any one may grasp the basic principles of storage battery action as well as their practical industrial applications. All electric and gasoline automobiles use storage batteries. Every automobile repairman, dealer or salesman should have a good knowledge of maintenance and repair of these important elements of the motor car mechanism. This book not only tells how to charge, care for and rebuild storage batteries but also outlines all the industrial uses. Learn how they run street cars, locomotives and factory trucks. Get an understanding of the important functions they perform in submarine boats, isolated lighting plants, railway switch and signal systems, marine applications, etc. This book tells how they are used in central station standby service, for starting automobile motors and in ignition systems. Every practical use of the modern storage battery is outlined in this treatise. 208 pages, fully illustrated.

Price, \$2.00

Wiring a House.

By HERBERT PRATT. Shows a house already built; tells just how to start about wiring it; where to begin; what wire to use; how to run it according to insurance rules; in fact, just the information you need. Directions apply equally to a shop. Fourth edition.

Price, 35 cents

Switchboards.

By WILLIAM BAXTER, JR. This book appeals to every engineer and electrician who wants to know the practical side of things. All sorts and conditions of dynamos, connections and circuits are shown by diagram and illustrate just how the switchboard should be connected. Includes direct and alternating current boards, also those for arc lighting, incandescent and power circuits. Special treatment on high voltage boards for power transmission. Second edition. 190 pages. Illustrated.

Price, \$2.00

Telephone Construction, Installation, Wiring, Operation and Maintenance.

By W. H. RADCLIFFE and H. C. CUSHING. This book gives the principles of construction and operation of both the Bell and Independent instruments; approved methods of installing and wiring them; the means of protecting them from lightning and abnormal currents; their connection together for operation as series or bridging stations; and rules for their inspection and maintenance. Line wiring and the wiring and operation of special telephone systems are also treated. 224 pages, 132 illustrations. Second revised edition.

Price, \$1.50

Wireless Telegraphy and Telephony Simply Explained.

By ALFRED P. MORGAN. This is undoubtedly one of the most complete and comprehensive treatises on the subject ever published, and a close study of its pages will enable one to master all the details of the wireless transmission of messages. The author has filled a long-felt want and has succeeded in furnishing a lucid, comprehensible explanation in simple language of the theory and practise of wireless telegraphy and telephony. Third edition. 154 pages, 156 engravings.

Price, \$1.50

Radio Time Signal Receiver.

By AUSTIN C. LESCARBOURA. This new book, "A Radio Time Signal Receiver," tells you how to build a simple outfit designed expressly for the beginner. You can build the outfit in your own workshop and install them for jewelers either on a one-payment or a rental basis. The apparatus is of such simple design that it may be made by the average amateur mechanic possessing a few ordinary tools. 42 pages. Paper.

Price, 35 cents

Experimental Wireless Stations.

By P. E. EDELMAN. The theory, design, construction and operation is fully treated including Wireless Telegraphy, Vacuum Tube, and quenched spark systems. The new enlarged 1920 edition is just issued and is strictly up to date, correct and complete. This book tells how to make apparatus to not only hear all telephoned radio messages, but also how to make simple equipment that works for transmission over reasonably long distances. Then there is a host of new information included. The first and only book to give you all the recent important radio improvements, some of which have never before been published. 24 chapters. 167 illustrations.

Price, \$2.50

FUEL

Combustion of Coal and the Prevention of Smoke.

By WM. M. BARR. This book has been prepared with special reference to the generation of heat by the combustion of the common fuels found in the United States, and deals particularly with the conditions necessary to the economic and smokeless combustion of bituminous coals in stationary and locomotive steam boilers. The presentation of this important subject is systematic and progressive. The arrangement of the book is in a series of practical questions, to which are appended accurate answers, which describe in language, free from technicalities, the several processes involved in the furnace combustion of American fuels; it clearly states the essential requisites for perfect combustion, and points out the best methods for furnace construction for obtaining the greatest quantity of heat from any given quality of coal. Nearly 350 pages, fully illustrated. Fifth edition.

Price, \$1.50

Smoke Prevention and Fuel Economy.

By BOOTH and KERSHAW. As the title indicates, this book of 197 pages and 75 illustrations deals with the problem of complete combustion, which it treats from the chemical and mechanical standpoints, besides pointing out the economical and humanitarian aspects of the question.

Price, \$3.00

GAS ENGINES AND GAS

Gas, Gasoline and Oil Engines.

By GARDNER D. HISCOX. Revised by VICTOR W. PAGÉ. Just issued new, revised and enlarged edition. Every user of a gas engine needs this book. Simple, instructive and right up-to-date. The only complete work on the subject. Tells all about internal combustion engineering, treating exhaustively on the design, construction and practical application of all forms of gas, gasoline, kerosene and crude petroleum-oil engines. Describes minutely all auxiliary systems, such as lubrication, carburetion and ignition. Considers the theory and management of all forms of explosive motors for stationary and marine work, automobiles, aeroplanes and motor-cycles. Includes also Producer Gas and Its Production. Invaluable instructions for all students, gas-engine owners, gas-engineers, patent experts, designers, mechanics, draftsmen and all having to do with the modern power. Illustrated by over 400 engravings, many specially made from engineering drawings, all in correct proportion. Nearly 700 octavo pages and 500 engravings.

Price, net, \$3.00

Gasoline Engines: Their Operation, Use and Care.

By A. HYATT VERRILL. A comprehensive, simple and practical work, treating of gasoline engines for stationary, marine or vehicle use; their construction, design, management, care, operation, repair, installation and troubles. A complete glossary of technical terms and an alphabetically arranged table of troubles and symptoms form a most valuable and unique feature of the book. $5\frac{1}{4} \times 7\frac{1}{2}$. Cloth. 275 pages, 152 illustrations.

Price, \$2.00

Gas Engine Construction.

Or How to Build a Half-Horse-power Gas Engine. By PARSELL and WEED. A practical treatise describing the theory and principles of the action of gas engines of various types, and the design and construction of a half-horse-power gas engine, with illustrations of the work in actual progress, together with dimensioned working drawings giving clearly the sizes of the various details. 300 pages. Third edition. Cloth. **Price, \$3.00**

Chemistry of Gas Manufacture.

By H. M. ROYLES. This book covers points likely to arise in the ordinary course of the duties of the engineer or manager of a gas works not large enough to necessitate the employment of a separate chemical staff. It treats of the testing of the raw materials employed in the manufacture of illuminating coal gas and of the gas produced. The preparation of standard solutions is given as well as the chemical and physical examination of gas coal. $5\frac{3}{4} \times 8\frac{3}{4}$. Cloth. 328 pages, 82 illustrations, 1 colored plate. **Price, \$5.00**

Modern Gas Engines and Producer Gas Plants.

By R. E. MATHOT, M.E. A practical treatise of 320 pages, fully illustrated by 175 detailed illustrations, setting forth the principles of gas engines and producer design, the selection and installation of an engine, conditions of perfect operation, producer-gas engines and their possibilities, the care of gas engines and producer-gas plants, with a chapter on volatile hydrocarbon and oil engines. This book has been endorsed by Dugal Clerk as a most useful work for all interested in gas engine installation and producer gas. **\$3.00**

The Gasoline Engine on the Farm: Its Operation, Repair and Uses.

By XENO W. PUTNAM. A useful and practical treatise on the modern gasoline and kerosene engine, its construction, management, repair and the many uses to which it can be applied in present-day farm life. It considers all the various household, shop and field uses of this up-to-date motor and includes chapters on engine installation, power transmission and the best arrangement of the power plant in reference to the work. $5\frac{1}{4} \times 7\frac{1}{2}$. Cloth. 527 pages, 179 illustrations. **Price, \$3.00**

How to Run and Install Two- and Four-Cycle Marine, Gasoline Engines.

By C. VON CULIN. New revised and enlarged edition just issued. The object of this little book is to furnish a pocket instructor for the beginner, the busy man who uses an engine for pleasure or profit, but who does not have the time or inclination for a technical book, but simply to thoroughly understand how to properly operate, install and care for his own engine. The index refers to each trouble, remedy and subject alphabetically. Being a quick reference to find the cause, remedy and prevention for troubles, and to become an expert with his own engine. Pocket size. Paper binding. **Price, 25 cents**

Modern Gas Tractor, Its Construction, Utility, Operation and Repair.

By VICTOR W. PAGÉ. Treats exhaustively on the design and construction of farm tractors and tractor power-plants, and gives complete instructions on their care, operation and repair. All types and sizes of gasoline, kerosene and oil tractors are described, and every phase of traction engineering practice fully covered. Invaluable to all desiring reliable information on gas motor propelled traction engines and their use. Second edition revised by much additional matter. $5\frac{1}{4} \times 7\frac{1}{2}$. Cloth, 504 pages, 228 illustrations, 3 folding plates. **Price, \$3.00**

GEARING AND CAMS

Bevel Gear Tables.

By D. AG. ENGSTROM. No one who has to do with bevel gears in any way should be without this book. The designer and draftsman will find it a great convenience, while to the machinist who turns up the blanks or cuts the teeth it is invaluable, as all needed dimensions are given and no fancy figuring need be done. Third edition. Cloth. **\$1.50**

Change Gear Devices.

By OSCAR E. PERRIGO. A book for every designer, draftsman and mechanic who is interested in feed changes for any kind of machines. This shows what has been done and how. Gives plans, patents and all information that you need. Saves hunting through patent records and reinventing old ideas. A standard work of reference. Third edition. **\$1.50**

Drafting of Cams.

By LOUIS ROUILLION. The laying out of cams is a serious problem unless you know how to go at it right. This puts you on the right road for practically any kind of cam you are likely to run up against. Third edition. **35 cents**

HYDRAULICS

Hydraulic Engineering.

By GARDNER D. HISCOX. A treatise on the properties, power, and resources of water for all purposes. Including the measurements of streams; the flow of water in pipes or conduits; the horse-power of falling water; turbine and impact water-wheels; wave-motors, centrifugal, reciprocating and air-lift pumps. With 300 figures and diagrams and 36 practical tables. 320 pages. **Price, \$4.50**

ICE AND REFRIGERATION

Pocketbook of Refrigeration and Ice Making.

By A. J. WALLIS-TAYLOR. This is one of the latest and most comprehensive reference books published on the subject of refrigeration and cold storage. It explains the properties

and refrigerating effect of the different fluids in use, the management of refrigerating machinery and the construction and insulation of cold rooms with their required pipe surface for different degrees of cold; freezing mixtures and non-freezing brines, temperatures of cold rooms for all kinds of provisions, cold storage charges for all classes of goods, ice making and storage of ice, data and memoranda for constant reference by refrigerating engineers, with nearly one hundred tables containing valuable references to every fact and condition required in the installment and operation of a refrigerating plant. New edition just published. **Price, \$2.00**

INVENTIONS—PATENTS

Inventor's Manual, How to Make a Patent Pay.

This is a book designed as a guide to inventors in perfecting their inventions, taking out their patents, and disposing of them. It is not in any sense a Patent Solicitor's circular nor a Patent Broker's advertisement. No advertisements of any description appear in the work. It is a book containing a quarter of a century's experience of a successful inventor, together with notes based upon the experience of many other inventors. Revised and enlarged second edition. Nearly 150 pages. Illustrated. **Price \$1.25**

KNOTS

Knots, Splices and Rope Work.

By A. HYATT VERRILL. This is a practical book giving complete and simple directions for making all the most useful and ornamental knots in common use, with chapters on Splicing, Pointing, Seizing, Serving, etc. This book is fully illustrated with 154 original engravings, which show how each knot, tie or splice is formed, and its appearance when finished. The book will be found of the greatest value to campers, yachtsmen, travelers or Boy Scouts, in fact, to anyone having occasion to use or handle rope or knots for any purpose. The book is thoroughly reliable and practical, and is not only a guide but a teacher. It is the standard work on the subject. Second edition revised. 128 pages, 154 original engravings. **Price, \$1.00**

LATHE WORK

Complete Practical Machinist.

By JOSHUA ROSE. The new, twentieth revised and enlarged edition is now ready. This is one of the best-known books on machine-shop work, and written for the practical workman in the language of the workshop. It gives full, practical instructions on the use of all kinds of metal-working tools, both hand and machine, and tells how the work should be properly done. It covers lathe work, vise work, drills and drilling, taps and dies, hardening and tempering, the making and use of tools, tool grinding, marking out work, machine tools, etc. No machinist's library is complete without this volume. 547 pages, 432 illustrations. (1920.) **Price \$3.00**

The Lathe—Its Design, Construction and Operation, With Practical Examples of Lathe Work.

By OSCAR E. PERRIGO. A new revised edition, and the only complete American work on the subject, written by a man who knows not only how work ought to be done, but who also knows how to do it, and how to convey this knowledge to others. It is strictly up-to-date in its descriptions and illustrations. Lathe history and the relations of the lathe to manufacturing are given; also a description of the various devices for feeds and thread cutting mechanisms from early efforts in this direction to the present time. Lathe design is thoroughly discussed, including back gearing, driving cones, thread-cutting gears, and all the essential element of the modern lathe. The classification of lathes is taken up, giving the essential differences of the several types of lathes including, as is usually understood, engine lathes, bench lathes, speed lathes, forge lathes, gap lathes, pulley lathes, forming lathes, multiple-spindle lathes, rapid-reduction lathes, precision lathes, turret lathes, special lathes, electrically-driven lathes, etc. In addition to the complete exposition on construction and design, much practical matter on lathe installation, care and operation has been incorporated in the enlarged new edition. All kinds of lathe attachments for drilling, milling, etc., are described and complete instructions are given to enable the novice machinist to grasp the art of lathe operation as well as the principles involved in design. A number of difficult machining operations are described at length and illustrated. The new edition has nearly 500 pages and 350 illustrations. **Price, \$3.00**

Turning and Boring Tapers.

By FRED H. COLVIN. There are two ways to turn tapers; the right way and one other. This treatise has to do with the right way; it tells you how to start the work properly, how to set the lathe, what tools to use and how to use them, and forty and one other little things that you should follow. Fourth edition. **Price, 35 cents**

LIQUID AIR

Liquid Air and the Liquefaction of Gases.

By T. O'CONOR SLOANE. The third revised edition of this book has just been issued. Much new material is added to it; and the all important uses of liquid air and gas processes in modern industry, in the production especially of nitrogen compounds, are described. The book gives the history of the theory, discovery, and manufacture of Liquid Air, and contains an illustrated description of all the experiments that have excited the wonder of audiences all over the country. It shows how liquid air, like water, is carried hundreds of miles and is handled in open buckets. It tells what may be expected from it in the near future. A book that renders simple one of the most perplexing chemical problems of the century. Startling developments illustrated by actual experiments. It is not only a work of scientific interest and authority, but is intended for the general reader, being written in a popular style—easily understood by everyone. 400 pages fully illustrated. (1920.) **Price, \$3.00**

LOCOMOTIVE ENGINEERING

Air-Brake Catechism.

By ROBERT H. BLACKALL. This book is a standard text book. It is the only practical and complete work published. Treats on the equipment manufactured by the Westinghouse Air Brake Company, including the E-T Locomotive Brake Equipment, the K (Quick-Service) Triple Valve for freight service; the L High Speed Triple Valve; the P-C Passenger Brake Equipment, and the Cross Compound Pump. The operation of all parts of the apparatus is explained in detail and a practical way of locating their peculiarities and remedying their defects is given. Endorsed and used by air-brake instructors and examiners on nearly every railroad in the United States. Twenty-sixth edition. 411 pages, fully illustrated with folding plates and diagrams. New edition.

Price, \$2.50

Application of Highly Superheated Steam to Locomotives.

By ROBERT GARBE. A practical book which cannot be recommended too highly to those motive-power men who are anxious to maintain the highest efficiency in their locomotives. Contains special chapters on Generation of Highly Superheated Steam; Superheated Steam and the Two-Cylinder Simple Engine; Compounding and Superheating; Designs of Locomotive Superheaters; Constructive Details of Locomotives Using Highly Superheated Steam. Experimental and Working Results. Illustrated with folding plates and tables. Cloth.

Price, \$3.00

Combustion of Coal and the Prevention of Smoke.

By WM. M. BARR. To be a success a fireman must be "Light on Coal." He must keep his fire in good condition, and prevent, as far as possible, the smoke nuisance. To do this, he should know how coal burns, how smoke is formed and the proper burning of fuel to obtain the best results. He can learn this, and more too, from Barr's "Combustion of Coal." It is an absolute authority on all questions relating to the firing of a locomotive. Fifth edition. Nearly 350 pages, fully illustrated.

Price, \$1.50

Diary of a Round-House Foreman.

By T. S. REILLY. This is the greatest book of railroad experiences ever published. Containing a fund of information and suggestions along the line of handling men, organizing, etc., that one cannot afford to miss. 176 pages.

Price, \$1.25

Link Motions, Valves and Valve Setting.

By FRED H. COLVIN, Associate Editor of "American Machinist." A handy book that clears up the mysteries of valve setting. Shows the different valve gears in use, how they work, and why. Piston and slide valves of different types are illustrated and explained. A book that every railroad man in the motive-power department ought to have. Fully illustrated. New revised and enlarged edition just published.

Price, 75 cents

Train Rule Examinations Made Easy.

By G. E. COLLINGWOOD. This is the only practical work on train rules in print. Every detail is covered, and puzzling points are explained in simple, comprehensive language, making it a practical treatise for the train dispatcher, engineer, trainman and all others who have to do with the movements of trains. Contains complete and reliable information of the Standard Code of Train Rules for single track. Shows signals in colors, as used on the different roads. Explains fully the practical application of train orders, giving a clear and definite understanding of all orders which may be used. Second edition revised. 256 pages. Fully illustrated with train signals in colors.

Price, \$1.50

Locomotive Boiler Construction.

By FRANK A. KLEINHANS. The only book showing how locomotive boilers are built in modern shops. Shows all types of boilers used; gives details of construction; practical facts, such as life of riveting punches and dies, work done per day, allowance for bending and flanging sheets and other data that means dollars to any railroad man. Second edition. 451 pages, 334 illustrations. Six folding plates. Cloth.

Price, \$3.50

Locomotive Breakdowns and Their Remedies.

By GEO. L. FOWLER. Revised by Wm. W. Wood, Air-Brake Instructor. Pocket edition. It is out of the question to try and tell you about every subject that is covered in this pocket edition of Locomotive Breakdowns. Just imagine all the common troubles that an engineer may expect to happen some time, and then add all of the unexpected ones, troubles that could occur, but that you had never thought about, and you will find that they are all treated with the very best methods of repair. Walschaert Locomotive Valve Gear Troubles, Electric Headlight Troubles, as well as Questions and Answers on the Air Brake, are all included. Eighth edition. 294 pages. Fully illustrated.

Price, \$1.50

Locomotive Catechism.

By ROBERT GRIMSHAW. Twenty-eighth revised and enlarged edition. This may well be called an encyclopedia of the locomotive. Contains over 4,000 examination questions with their answers, including among them those asked at the first, second and third year's examinations. 825 pages, 437 illustrations and 3 folding plates.

Price, \$2.50

Westinghouse E. T. Air-Brake Instruction Pocket-book Catechism.

By WM. W. WOOD, Air-Brake Instructor. A practical work containing examination questions and answers on the E. T. Equipment. Covering what the E. T. Brake is. How it should be operated. What to do when defective. Not a question can be asked of the engineman up for promotion on either the No. 5 or the No. 6 E. T. equipment that is not asked and answered in the book. If you want to thoroughly understand the E. T. equipment get a copy of this book. It covers every detail. Makes air-brake troubles and examinations easy. Fully illustrated with colored plates, showing various pressures. Cloth. (1920.)

Price, \$2.50

Practical Instructor and Reference Book for Locomotive Firemen and Engineers.

By CHAS. F. LOCKHART. An entirely new book on the locomotive. It appeals to every railroad man, as it tells him how things are done and the right way to do them. Written by a man who has had years of practical experience in locomotive shops and on the road firing and running. The information given in this book cannot be found in any other similar treatise. Eight hundred and fifty-one questions with their answers are included, which will prove specially helpful to those preparing for examination. 368 pages, 88 illustrations. Cloth. **Price, \$2.00**

Prevention of Railroad Accidents, or Safety in Railroading.

By GEORGE BRADSHAW. This book is a heart-to-heart talk with railroad employees, dealing with facts, not theories, and showing the men in the ranks, from every-day experience, how accidents occur and how they may be avoided. The book is illustrated with seventy original photographs and drawings showing the safe and unsafe methods of work. No visionary schemes, no ideal pictures. Just plain facts and practical suggestions are given. Every railroad employee who reads the book is a better and safer man to have in railroad service. It gives just the information which will be the means of preventing many injuries and deaths. All railroad employees should procure a copy; read it, and do their part in preventing accidents. 169 pages. Pocket size. Fully illustrated. **Price, 50 cents**

Walschaert Locomotive Valve Gear.

By WM. W. WOOD. If you would thoroughly understand the Walschaert Valve Gear, you should possess a copy of this book. The author divides the subject into four divisions, as follows: I. Analysis of the gear. II. Designing and erection of the gear. III. Advantages of the gear. IV. Questions and answers relating to the Walschaert Valve Gear. This book is specially valuable to those preparing for promotion. Third edition. 245 pages. Fully illustrated. Cloth. **Price, \$2.50**

MACHINE SHOP PRACTICE

Modern Machine Shop Construction, Equipment and Management.

By OSCAR E. PERRIGO. The only work published that describes the Modern Machine Shop or Manufacturing Plant from the time the grass is growing on the site intended for it until the finished product is shipped. Just the book needed by those contemplating the erection of modern shop buildings, the rebuilding and reorganization of old ones or the introduction of Modern Shop Methods, Time and Cost Systems. It is a book written and illustrated by a practical shop man for practical shop men who are too busy to read theories and want facts. It is the most complete all-around book of its kind ever published. Second edition. 384 pages, 219 original and specially-made illustrations. **Price, \$5.00**

EVERY PRACTICAL MAN NEEDS

**A MAGAZINE WHICH WILL TELL HIM
HOW TO MAKE AND DO THINGS**

HAVE US ENTER YOUR SUBSCRIPTION

to the best mechanical magazine on the market. Only **Two Dollars** a year for twelve numbers. Subscribe to-day to

EVERYDAY ENGINEERING

A monthly magazine devoted to practical mechanics for everyday men. Its aim is to popularize engineering as a science, teaching the elements of applied mechanics and electricity in a straightforward and understandable manner. The magazine maintains its own experimental laboratory, where the devices described in articles submitted to the Editor are first tried out and tested before they are published. This important innovation places the standard of the published material very high, and it insures accuracy and dependability.

The magazine is the only one in this country that specializes in practical model building. Articles in past issues have given comprehensive designs for many model boats, including submarines and chasers, model steam and gasoline engines, electric motors and generators, etc., etc. This feature is a permanent one in the magazine.

Another popular department is that devoted to automobiles and airplanes. Care, maintenance, and operation receive full and authoritative treatment. Every article is written from the practical, everyday man standpoint, rather than from that of the professional.

The magazine entertains while it instructs. It is a journal of practical, dependable information, given in a style that it may be readily assimilated and applied by the man with little or no technical training. The aim is to place before the man who leans toward practical mechanics a series of concise, crisp, readable talks on what is going on and *how it is done*. These articles are profusely illustrated with clear, snappy photographs, specially posed to illustrate the subject in the magazine's own studio by its own staff of technically-trained illustrators and editors.

The subscription price of the magazine is two dollars per year in U. S., two dollars and twenty-five cents in Canada and three dollars in foreign countries. Sample copy sent on receipt of twenty cents.

Machine Shop Arithmetic.

By COLVIN-CHENEY. Most popular book for shop men. Shows how all shop problems are worked out and "why." Includes change gears for cutting any threads; drills, taps, shank and force fits; metric system of measurements and threads. Used by all classes of mechanics and for instruction in Y. M. C. A. and other schools. Seventh edition. 131 pages.

Price, 75 cents.

Abrasives and Abrasive Wheels.

By FRED B. JACOBS. A new book for everyone interested in abrasives or grinding. A careful reading of the book will not only make mechanics better able to use abrasives intelligently, but it will also tell the shop superintendent of many short cuts and efficiency-increasing kinks. The economic advantage in using large grinding wheels are fully explained, together with many other things that will tend to give the superintendent or workman a keen insight into abrasive engineering. 340 pages, 200 illustrations. This is an indispensable book for every machinist.

Price, \$3.00

American Tool Making and Interchangeable Manufacturing.

By J. V. WOODWORTH. In its 500-odd pages the one subject only, Tool Making, and whatever relates thereto, is dealt with. The work stands without a rival. It is a complete practical treatise on the art of American Tool Making and system of interchangeable manufacturing as carried on to-day in the United States. In it are described and illustrated all of the different types and classes of small tools, fixtures, devices and special appliances which are in general use in all machine-manufacturing and metal-working establishments where economy, capacity and interchangeability in the production of machined metal parts are imperative. The science of jig making is exhaustively discussed, and particular attention is paid to drill jigs, boring, profiling and milling fixtures and other devices in which the parts to be machined are located and fastened within the contrivances. All of the tools, fixtures and devices illustrated and described have been or are used for the actual production of work, such as parts of drill presses, lathes, patented machinery, typewriters, electrical apparatus, mechanical appliances, brass goods, composition parts, mould products, sheet metal articles, drop forgings, jewelry, watches, medals, coins, etc. Second edition. 531 pages.

Price, \$4.50

Henley's Encyclopedia of Practical Engineering and Allied Trades.

Edited by JOSEPH G. HORNER, A.M.I.Mech.E. This book covers the entire practice of Civil and Mechanical Engineering. The best known experts in all branches of engineering have contributed to these volumes. The Cyclopaedia is admirably well adapted to the needs of the beginner and the self-taught practical man, as well as the mechanical engineer, designer, draftsman, shop superintendent, foreman and machinist.

It is a modern treatise in five volumes. Handsomely bound in half morocco, each volume containing nearly 500 pages, with thousands of illustrations, including diagrammatic and sectional drawings with full explanatory details.

Price, \$30.00. For the complete set of five volumes.

THE WHOLE FIELD OF MECHANICAL MOVEMENTS COVERED BY MR. HISCOX'S TWO BOOKS

We publish two books by Gardner D. Hiscox that will keep you from "inventing" things that have been done before, and suggest ways of doing things that you have not thought of before. Many a man spends time and money, pondering over some mechanical problem, only to learn, after he has solved the problem, that the same thing has been accomplished and put in practice by others long before. Time and money spent in an effort to accomplish what has already been accomplished are time and money lost. The whole field of mechanics, every known mechanical movement, and practically every device is covered by these two books. If the thing you want has been invented, it is illustrated in them. If it hasn't been invented, then you'll find in them the nearest things to what you want, some movement or device that will apply in your case, perhaps; or which will give you a key from which to work. No book or set of books ever published is of more real value to the inventor, draftsman or practical mechanic than the two volumes described below.

Mechanical Movements, Powers and Devices.

By GARDNER D. HISCOX. This is a collection of 1,890 engravings of different mechanical motions and appliances, accompanied by appropriate text, making it a book of great value to the inventor, the draftsman, and to all readers with mechanical tastes. The book is divided into eighteen sections or chapters, in which the subject-matter is classified under the following heads: Mechanical Powers; Transmission of Power; Measurement of Power; Steam Power; Air Power Appliances; Electric Power and Construction; Navigation and Roads; Gearing; Motion and Devices; Controlling Motion; Horological; Mining; Mill and Factory Appliances; Construction and Devices; Drafting Devices; Miscellaneous Devices, etc. Fifteenth edition. 400 octavo pages.

Price, \$1.00

Mechanical Appliances, Mechanical Movements and Novelties of Construction.

By GARDNER D. HISCOX. This is a supplementary volume to the one upon mechanical movements. Unlike the first volume, which is more elementary in character, this volume contains illustrations and descriptions of many combinations of motions and of mechanical devices and appliances found in different lines of machinery, each device being shown by a line drawing with a description showing its working parts and the method of operation. From the multitude of devices described and illustrated might be mentioned, in passing, such items as conveyors and elevators, Prony brakes, thermometers, various types of boilers, solar engines, oil-fuel burners, condensers, evaporators, Corliss and other valve gears, governors, gas engines, water motors of various descriptions, air ships, motors and dynamos, automobiles and motor bicycles, railway lock signals, car couplers, link and gear motions, ball bearings, breech block mechanism for heavy guns, and a large accumulation of others of equal importance. 1,000 specially made engravings. 396 octavo pages. Fourth revised edition.

Price, \$1.00

"Shop Kinks."

By ROBERT GRIMSHAW. This shows special methods of doing work of various kinds, and releasing cost of production. Has hints and kinks from some of the largest shops in this country and Europe. You are almost sure to find some that apply to your work, and in such a way as to save time and trouble. 400 pages. Fifth edition. Cloth. **Price, \$3.00**

Machine Shop Tools and Shop Practice.

By W. H. VANDERVOORT. A work of 555 pages and 673 illustrations, describing in every detail the construction, operation, and manipulation of both hand and machine tools. Includes chapters on filing, fitting, and scraping surfaces; on drills, reamers, taps, and dies; the lathe and its tools; planers, shapers, and their tools; milling machines and cutters; gear cutters and gear cutting; drilling machines and drill work; grinding machines and their work; hardening and tempering; gearing, belting, and transmission machinery; useful data and tables. Sixth edition. Cloth. **Price, \$4.50**

Model Making.

By RAYMOND FRANCIS YATES. A new book for the mechanic and model maker. This is the first book of its kind to be published in this country and all those interested in model engineering should have a copy. The first eight chapters are devoted to such subjects as Silver Soldering, Heat Treatment of Steel, Lathe Work, Pattern Making, Grinding, etc. The remaining twenty-four chapters describe the construction of various models such as rapid fire naval guns, speed boats, model steam engines, turbines, etc.

This book must not be confused with those describing the construction of toys now on the market. It is a practical treatise on model engineering and construction. 400 pages. 301 illustrations. **Price, \$3.00**

The Modern Machinist.

By JOHN T. USHER. This book might be called a compendium of shop methods, showing a variety of special tools and appliances which will give new ideas to many mechanics from the superintendent down to the man at the bench. It will be found a valuable addition to any machinist's library and should be consulted whenever a new or difficult job is to be done, whether it is boring, milling, turning, or planing, as they are all treated in a practical manner. Fifth edition. 320 pages, 250 illustrations. Cloth. **Price, \$2.50**

Threads and Thread Cutting.

By COLVIN and STABEL. This clears up many of the mysteries of thread cutting, such as double and triple threads, internal threads, catching threads, use of hobs, etc. Contains a lot of useful hints and several tables. Third edition. **35 cents**

MARINE ENGINEERING

The Naval Architect's and Shipbuilder's Pocket-book

of Formulæ, Rules, and Tables and Marine Engineer's and Surveyor's Handy Book of Reference. By CLEMENT MACKROW and LLOYD WOOLLARD. The eleventh revised and enlarged edition of this most comprehensive work has just been issued. It is absolutely indispensable to all engaged in the Shipbuilding Industry, as it condenses into a compact form all data and formulæ that are ordinarily required. The book is completely up to date, including among other subjects a section on Aeronautics. 750 pages, limp leather binding.

Price, \$6.00 net

Marine Engines and Boilers, Their Design and Construction. The Standard Book.

By DR. G. BAUER, LESLIE S. ROBERTSON and S. BRYAN DONKIN. In the words of Dr. Bauer, the present work owes its origin to an oft felt want of a condensed treatise embodying the theoretical and practical rules used in designing marine engines and boilers. The need of such a work has been felt by most engineers engaged in the construction and working of marine engines, not only by the younger men, but also by those of greater experience. The fact that the original German work was written by the chief engineer of the famous Vulcan Works, Stettin, is in itself a guarantee that this book is in all respects thoroughly up-to-date, and that it embodies all the information which is necessary for the design and construction of the highest types of marine engines and boilers. It may be said that the motive power which Dr. Bauer has placed in the fast German liners that have been turned out of late years from the Stettin Works represent the very best practice in marine engineering of the present day. The work is clearly written, thoroughly systematic, theoretically sound; while the character of the plans, drawings, tables, and statistics is without reproach. The illustrations are careful reproductions from actual working drawings, with some well-executed photographic views of completed engines and boilers. 744 pages, 550 illustrations, and numerous tables. Cloth.

Price, \$10.00 net

MANUAL TRAINING

Economics of Manual Training.

By LOUIS ROUILLION. The only book that gives just the information needed by all interested in manual training, regarding buildings, equipment and supplies. Shows exactly what is needed for all grades of the work from the Kindergarten to the High and Normal School. Gives itemized lists of everything needed and tells just what it ought to cost. Also shows where to buy supplies. Illustrated. Second edition. Cloth.

Price, \$2.00

MINING

Prospector's Field-Book and Guide.

By H. S. OSBORN. 1920 edition, revised and enlarged by M. W. von Bernewitz. The last edition of this volume was published in 1910. It and the previous seven editions were suitable for those times. The new ninth (1920) edition will be found suitable for the present time. While the old-time prospector will always be an important factor, the knowledge of and search for the common and rarer minerals is bringing out men who are trained to some degree. In the field they need a handy and suggestive pocket-book containing hints on prospecting—where to search and how to test—couched in simple terms. The chapter on preliminary instructions covers the fundamentals of a study of the earth's crust. Then follow discussions on practical mineralogy, crystallography, the value of the blowpipe in prospecting, surveying, and chemical tests in the field. Separate chapters are given to the precious and base metals, also to the non-metallic minerals. The chapter on the non-ferrous or alloy group of minerals is entirely new, while the section on oil has been expanded. Surface indications for copper receive full attention. The chapter on gems has been rewritten and matters concerning gemstones used for industrial purposes, such as abrasives, included. A general chapter covers many useful minerals and salts. An important guide and suggestive aid throughout the new book are the many brief descriptions of ore deposits of all minerals occurring in scattered parts of the world. No other prospector's book contains this class of information. In the appendix will be found numbers of useful tables, and a complete glossary of mining and mineralogical terms. The ninth edition of Osborn's "Prospector's Field Book and Guide" will be found up to date, worth while, and full value for the money asked. Flexible fabrikoid. 375 pages. 57 illustrations. 1920 edition. **Price, \$3.00**

PATTERN MAKING

Practical Pattern Making.

By F. W. BARROWS. This book, now in its second edition, is a comprehensive and entirely practical treatise on the subject of pattern making, illustrating pattern work in both wood and metal, and with definite instructions on the use of plaster of paris in the trade. It gives specific and detailed descriptions of the materials used by pattern makers and describes the tools; both those for the bench and the more interesting machine tools; having complete chapters on the lathe, the circular saw and the band saw. It gives many examples of pattern work, each one fully illustrated and explained with much detail. These examples, in their great variety, offer much that will be found of interest to all pattern makers, and especially to the younger ones, who are seeking information on the more advanced branches of their trade. Containing nearly 350 pages and 170 illustrations. Second edition, revised and enlarged. **Price, \$2.50**

PERFUMERY

Henley's Twentieth Century Book of Receipts, Formulas and Processes.

Edited by G. D. HIRCOX. The most valuable techno-chemical receipt book published. Contains over 10,000 practical receipts, many of which will prove of special value to the perfumer. **Price, \$4.00**

Perfumes and Cosmetics, Their Preparation and Manufacture.

By G. W. ASKINSON, Perfumer. A comprehensive treatise, in which there has been nothing omitted that could be of value to the perfumer or manufacturer of toilet preparations. Complete directions for making handkerchief perfumes, smelling-salts, sachets, fumigating pastiles; preparations for the care of the skin, the mouth, the hair, cosmetics, hair dyes and other toilet articles are given, also a detailed description of aromatic substances; their nature, tests of purity, and wholesale manufacture, including a chapter on synthetic products, with formulas for their use. A book of general, as well as professional interest, meeting the wants not only of the druggist and perfume manufacturer, but also of the general public. Fourth edition much enlarged and brought up-to-date. Nearly 400 pages, illustrated. **\$5.00**

PLUMBING

Standard Practical Plumbing.

By R. M. STARBUCK. This is a complete treatise and covers the subject of modern plumbing in all its branches. It treats exhaustively on the skilled work of the plumber and the theory underlying plumbing devices and operations, and commends itself at once to anyone working in any branch of the plumbing trade. A large amount of space is devoted to a very complete and practical treatment of the subjects of hot water supply, circulation and range boiler work. Another valuable feature is the special chapter on drawing for plumbers. The illustrations, of which there are three hundred and forty-seven, one hundred being full-page plates, were drawn expressly for this book and show the most modern and best American practice in plumbing construction. 6½ x 9¼. Cloth, 406 pages, 347 illustrations. **Price, \$3.50**

Mechanical Drawing for Plumbers.

By R. M. STARBUCK. A concise, comprehensive and practical treatise on the subject of mechanical drawing in its various modern applications to the work of all who are in any way connected with the plumbing trade. Nothing will so help the plumber in estimating and in explaining work to customers and workmen as a knowledge of drawing, and to the workman it is of inestimable value if he is to rise above his position to positions of greater responsibility. 150 illustrations. **Price, \$2.00**

Modern Plumbing Illustrated.

By R. M. STARBUCK. The author of this book, Mr. R. M. Starbuck, is one of the leading authorities on plumbing in the United States. The book represents the highest standard of plumbing work. A very comprehensive work, illustrating and describing the drainage and ventilation of dwellings, apartments and public buildings. The very latest and most approved methods in all branches of sanitary installation are given. The standard book for master plumbers, architects, builders, plumbing inspectors, boards of health, boards of plumbing examiners and for the property owner, as well as the workman and apprentice. It contains fifty-seven entirely new and large full pages of illustrations with descriptive text, all of which have been made specially for this work. These plates show all kinds of modern plumbing work. Each plate is accompanied by several pages of text, giving notes and practical suggestions, sizes of pipe, proper measurements for setting up work, etc. Suggestions on estimating plumbing construction are also included. 407 octavo pages, fully illustrated by 57 full-page engravings. **Price, \$5.00**

RECIPE BOOK

Henley's Twentieth Century Book of Recipes, Formulas and Processes.

Edited by GARDNER D. HISCOX. The most valuable technico-chemical formulæ book published, including over 10,000 selected scientific, chemical, technological and practical recipes and processes. This book of 800 pages is the most complete book of recipes ever published, giving thousands of recipes for the manufacture of valuable articles for everyday use. Hints, helps, practical ideas and secret processes are revealed within its pages. It covers every branch of the useful arts and tells thousands of ways of making money and is just the book everyone should have at his command. The pages are filled with matters of intense interest and immeasurable practical value to the photographer, the perfumer, the painter, the manufacturer of glues, pastes, cements and mucilages, the physician, the druggist, the electrician, the dentist, the engineer, the foundryman, the machinist, the potter, the tanner, the confectioner, the chiropodist, the manufacturer of chemical novelties and toilet preparations, the dyer, the electroplater, the enameler, the engraver, the provisioner, the glass worker, the goldbeater, the watchmaker and jeweler, the ink manufacturer, the optician, the farmer, the dairyman, the paper maker, the metal worker, the soap maker, the veterinary surgeon, and the technologist in general. A book to which you may turn with confidence that you will find what you are looking for. A mine of information up-to-date in every respect. Contains an immense number of formulas that every one ought to have that are not found in any other work. 1920 edition. Cloth binding. **Price, \$4.00**

RUBBER

Henley's Twentieth Century Book of Receipts, Formulas and Processes.

Edited by GARDNER D. HISCOX. Contains upward of 10,000 practical receipts, including among them formulas on artificial rubber. **Price, \$4.00**

Rubber Hand Stamps and the Manipulation of India Rubber.

By T. O'CONOR SLOANE. This book gives full details of all points, treating in a concise and simple manner the elements of nearly everything it is necessary to understand for a commencement in any branch of the India rubber manufacture. The making of all kinds of rubber hand stamps, small articles of India rubber, U. S. Government composition, dating hand stamps, the manipulation of sheet rubber, toy balloons, India rubber solutions, cements, blackings, renovating varnish, and treatment for India rubber shoes, etc.; the hektograph stamp inks, and miscellaneous notes, with a short account of the discovery, collection and manufacture of India rubber are set forth in a manner designed to be readily understood, the explanation being plain and simple. Third edition. 175 pages, illustrated. **Price, \$1.25**

SAWS

Saw Filing and Management of Saws.

By ROBERT GRIMSHAW. A practical hand book on filing, gumming, swaging, hammering and the brazing of band saws, the speed, work, and power to run circular saws, etc. A handy book for those who have charge of saws, or for those mechanics who do their own filing, as it deals with the proper shape and pitches of saw teeth of all kinds and gives many useful hints and rules for gumming, setting, and filing, and is a practical aid to those who use saws for any purpose. Third edition, revised and enlarged. Illustrated. **Price, \$1.50**

SCREW CUTTING

Threads and Thread Cutting.

By COLVIN and STABLE. This clears up many of the mysteries of thread cutting, such as double and triple threads, internal threads, catching threads, use of hobs, etc. Contains a lot of useful hints and several tables. Third edition. **35 cents**

STEAM ENGINEERING

Horse-power Chart.

Shows the horse-power of any stationary engine without calculation. No matter what the cylinder diameter or stroke; the steam pressure or cut-off; the revolutions, or whether condensing or non-condensing, it's all there. Easy to use, accurate, and saves time and calculations. Especially useful to engineers and designers. **Price, 50 cents**

Steam Engine Troubles.

By H. HAMKENS. It is safe to say that no book has ever been published which gives the practical engineer such valuable and comprehensive information on steam engine design and troubles. There are descriptions of cylinders, valves, pistons, frames, pillow blocks and other bearings, connecting rods, wristplates, dashpots, reachrods, valve gears, governors, piping, throttle and emergency valves, safety stops, flywheels, oilers, etc. If there is any trouble with these parts, the book gives you the reasons and tells how to remedy them. 350 pages, 276 illustrations. **Price, \$2.50**

American Stationary Engineering.

By W. E. CRANE. A new book by a well-known author. Begins at the boiler room and takes in the whole power plant. Contains the result of years of practical experience in all sorts of engine rooms and gives exact information that cannot be found elsewhere. It's plain enough for practical men and yet of value to those high in the profession. Has a complete examination for a license. Third edition revised and enlarged. 345 pages. 131 illustrations. Cloth. **Price, \$2.50**

Steam Engine Catechism.

By ROBERT GRIMSHAW. This volume of 413 pages is not only a catechism on the question and answer principle, but it contains formulas and worked-out answers for all the steam problems that appertain to the operation and management of the steam engine. Sixteenth edition. **Price, \$2.00**

Boiler Room Chart.

By GEO. L. FOWLER. A chart—size 14 x 28 inches—showing in isometric perspective the mechanism belonging in a modern boiler room. The various parts are shown broken or removed, so that the internal construction is fully illustrated. Each part is given a reference number, and these, with the corresponding name, are given in a glossary printed at the sides. **Price, 25 cents**

Engine Runner's Catechism.

By ROBERT GRIMSHAW. Tells how to erect, adjust and run the principal steam engines in use in the United States. The work is of a handy size for the pocket. To young engineers this catechism will be of great value, especially to those who may be preparing to go forward to be examined for certificates of competency; and to engineers generally it will be of no little service, as they will find in this volume more really practical and useful information than is to be found anywhere else within a like compass. 387 pages. Seventh edition. **Price, \$2.00**

Modern Steam Engineering in Theory and Practice.

By GARDNER D. HISCOX. This is a complete and practical work issued for stationary engineers and firemen dealing with the care and management of boilers, engines, pumps, superheated steam, refrigerating machinery, dynamos, motors, elevators, air compressors, and all other branches with which the modern engineer must be familiar. Nearly 200 questions with their answers on steam and electrical engineering, likely to be asked by the examining board, are included. Third edition, 487 pages, 405 engravings. Cloth. **Price, \$3.50**

Steam Engineer's Arithmetic.

By COLVIN-CHENEY. A practical pocket book for the steam engineer. Shows how to work the problems of the engine room and shows "why." Tells how to figure horse-power of engines and boilers; area of boilers; has tables of areas and circumferences; steam tables; has a dictionary of engineering terms. Puts you onto all of the little kinks in figuring whatever there is to figure around a power plant. Tells you about the heat unit; absolute zero; adiabatic expansion; duty of engines; factor of safety; and 1,001 other things; and everything is plain and simple—not the hardest way to figure, but the easiest. Second edition. **Price, 75 cents**

STEAM HEATING and VENTILATING

Practical Steam, Hot-Water Heating and Ventilation.

By A. G. KING. This book has been prepared for the use of all engaged in the business of steam, hot-water heating and ventilation. Tells how to get heating contracts, how to install heating and ventilating apparatus, the best business methods to be used, with "Tricks of the Trade" for shop use. Rules and data for estimating radiation and cost and such tables and information as make it an indispensable work for everyone interested in steam, hot-water heating and ventilation. It describes all the principal systems of steam, hot-water, vacuum, vapor and vacuum-vapor heating, together with the new accelerated systems of hot-water circulation, including chapters on up-to-date methods of ventilation and the fan or blower system of heating and ventilation. Second edition. 367 pages, 300 detailed engravings. Cloth. **\$3.50**

500 Plain Answers to Direct Questions on Steam, Hot-Water, Vapor and Vacuum Heating Practice.

By ALFRED G. KING. This work, just off the press, is arranged in question and answer form; it is intended as a guide and text-book for the younger inexperienced fitter and as a reference book for all fitters. All long and tedious discussions and descriptions formerly considered so important have been eliminated, and the theory and laws of heat and the various old and modern methods and appliances used for heating and ventilating are treated in a concise manner. This is the standard Question and Answer examination book on Steam and Hot Water Heating, etc. 200 pages, 127 illustrations. Octavo. Cloth. **Price, \$2.00**

STEEL

Hardening, Tempering, Annealing and Forging of Steel.

By J. V. WOODWORTH. A book containing special directions for the successful hardening and tempering of all steel tools. Milling cutters, taps, thread dies, reamers, both solid and shell, hollow mills, punches and dies, and all kinds of sheet-

metal working tools, shear blades, saws, fine cutlery and metal-cutting tools of all descriptions, as well as for all implements of steel, both large and small, the simplest, and most satisfactory hardening and tempering processes are presented. 320 pages, 250 illustrations. Fourth edition. Cloth. **Price, \$3.00**

Steel: Its Selection, Annealing, Hardening and Tempering.

By E. R. MARKHAM. This work was formerly known as "The American Steel Worker," but on the publication of the new, revised edition, the publishers deemed it advisable to change its title to a more suitable one. This is the standard work on hardening, tempering, and annealing steel of all kinds. This book tells how to select, and how to work, temper, harden, and anneal steel for everything on earth. It is the standard book on selecting, hardening, and tempering all grades of steel. 400 pages. Very fully illustrated. Fourth edition. **Price, \$3.00**

TRACTORS

The Modern Gas Tractor.

By VICTOR W. PAGÉ. A complete treatise describing all types and sizes of gasoline, kerosene, and oil tractors. Considers design and construction exhaustively, gives complete instruction for care, operation and repair, outlines all practical applications on the road and in the field. The best and latest work on farm tractors and tractor power plants. A work needed by farmers, students, blacksmiths, mechanics, salesmen, implement dealers, designers, and engineers. Second edition revised and much enlarged. 504 pages. Nearly 300 illustrations and folding plates. **Price, \$3.00**

TURBINES

Marine Steam Turbines.

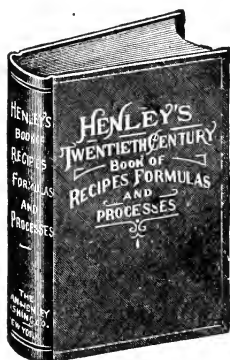
By DR. G. BAUER and O. LASCHE. Assisted by E. Ludwig and H. Vogel. Translated from the German and edited by M. G. S. Swallow. The book is essentially practical and discusses turbines in which the full expansion of steam passes through a number of separate turbines arranged for driving two or more shafts, as in the Parsons system, and turbines in which the complete expansion of steam from inlet to exhaust pressure occurs in a turbine on one shaft, as in the case of the Curtis machines. It will enable a designer to carry out all the ordinary calculation necessary for the construction of steam turbines, hence it fills a want which is hardly met by larger and more theoretical works. Numerous tables, curves and diagrams will be found, which explain with remarkable lucidity the reason why turbine blades are designed as they are, the course which steam takes through turbines of various types, the thermodynamics of steam turbine calculation, the influence of vacuum on steam consumption of steam turbines, etc. In a word, the very information which a designer and builder of steam turbines most requires. Large octavo, 214 pages. Fully illustrated and containing 18 tables, including an entropy chart. **Price, \$4.00 net**

The Most Valuable Techno-Chemical Recipe
Book Ever Offered to the Public!

Henley's Twentieth Century Book of RECIPES, FORMULAS AND PROCESSES

Price \$4.00

THIS book of 800 pages is the most complete Book of Recipes ever published, giving thousands of recipes for the manufacture of valuable articles for every-day use. Hints, Helps,



Practical Ideas and Secret Processes are revealed within its pages. It covers every branch of the useful arts and tells thousands of ways of making money and is just the book everyone should have at his command.

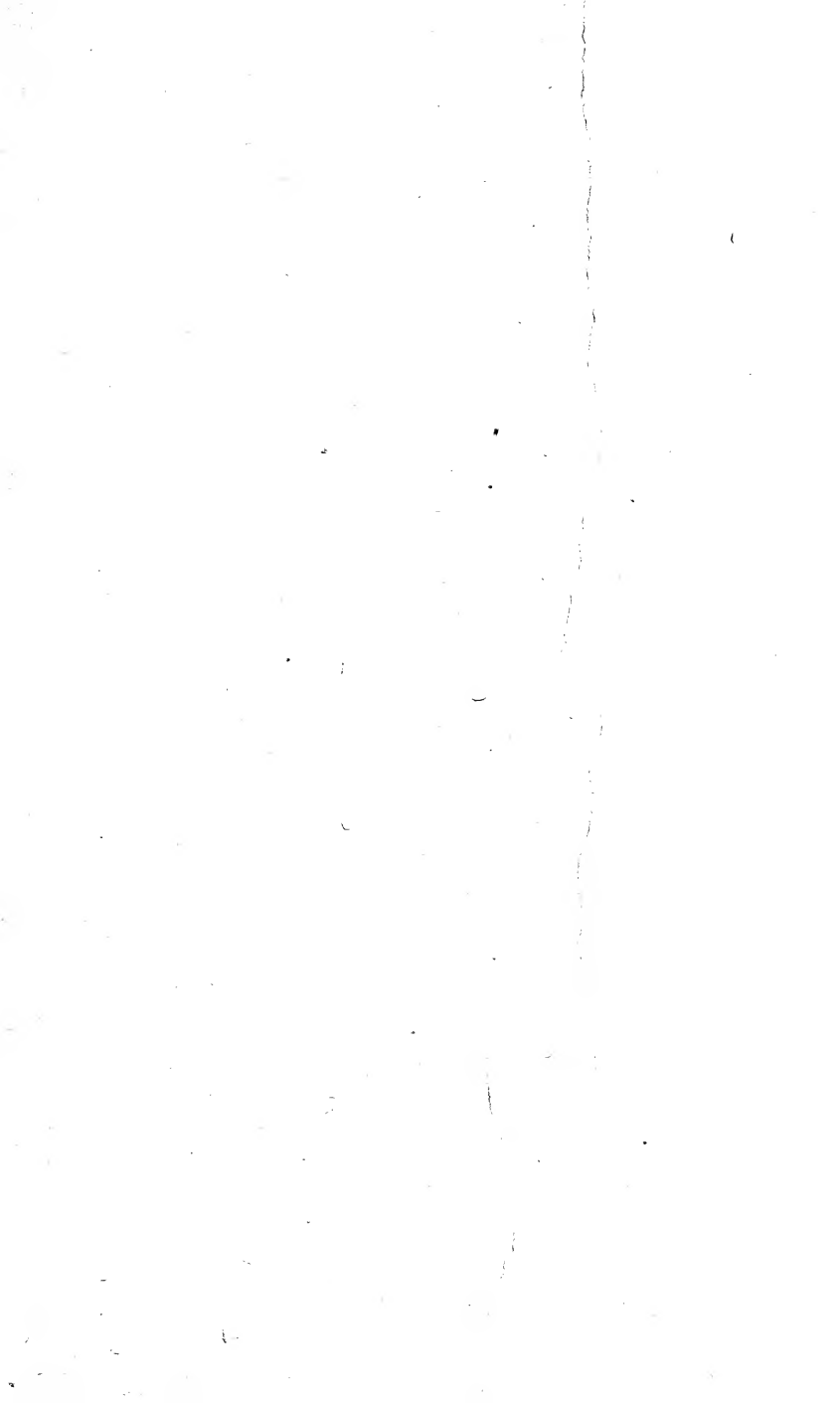
The pages are filled with matters of intense interest and immeasurable practical value to the Photographer, the Perfumer, the Painter, the Manufacturer of Glues, Pastes, Cements and Mucilages, the Physician, the Druggist, the Electrician, the Dentist, the Engineer, the Foundryman, the Machinist, the Potter, the Tanner, the Confectioner, the Chiropodist, the Manufacturer of Chemical Novelties and Toilet Preparations, the Dyer, the Electroplater, the

Enameler, the Engraver, the Provisioner, the Glass Worker, the Goldbeater, the Watchmaker and Jeweler, the Ink Manufacturer, the Optician, the Farmer, the Dairyman, the Paper Maker, the Metal Worker, the Soap Maker, the Veterinary Surgeon and the Technologist in general.

A book to which you may turn with confidence that you will find what you are looking for. A mine of information, up-to-date in every respect. Contains an immense number of formulas that every one ought to have that are not found in any other work.

10,000 Practical Formulas and Processes
The Best Way to Make Everything
ONE USEFUL RECIPE WILL BE WORTH MORE
THAN TEN TIMES THE PRICE OF THE BOOK

(See page 35 for further description of the book.)



**Every Practical Man Needs A Magazine Which
Will Tell Him How To Make And Do Things**

Have us enter your subscription to the best mechanical magazine on the market. Only two dollars a year for twelve numbers. Subscribe today to

Everyday Engineering Magazine

A MONTHLY magazine devoted whole-heartedly to Model Making, Electricity, Chemistry, Mechanics, Radiotelegraphy, etc. It is a magazine with a peculiar and interesting "mechanical personality" that has made many friends in the past and will make many in the future. Its articles are alive with interest, lucrative with facts and bright in appearance with their many clear illustrations and their pleasant arrangement.

"Everyday's" articles are prepared by many of the best technical journalists in the United States. Among these are mechanical engineers, electrical engineers, model makers, chemists and radio enthusiasts. These men write with a knowledge of what the readers of Everyday like and need. Many of them are experimental engineers and "hobbyists" who well know what their own class like to read best.

Do you like to make model steam engines? Do you know how high-frequency alternators work? Would you like to read some understandable literature on the inner nature of steel? Do you know how to manipulate a micrometer? Would you like to make simple experiments in radioactivity? Do you build model power racing boats or airplanes? Do you know how Diesel engines work? Do you understand synthetic chemistry? Can you perform qualitative chemical analysis? Do you build dynamo electric machines? Would a model gyroscope railroad interest you? Do you like to build or read about model railroads, both steam and electric? Can you describe the calibration of electrical measuring instruments? Understand the mysteries of liquid air or would you like to experiment with it? If you like to do these things, and you don't read Everyday Engineering, you are missing a factor that will make your work or hobby more interesting and beneficial—probably you need just the inspiration that "Everyday" is able to offer.

"Everyday" will be your helpmate and advisor during the period of one year for \$2.00.

Sample copy sent on receipt of 20 cents. Send your subscription direct to

The Norman W. Henley Pub. Co.
2 West 45th Street, New York